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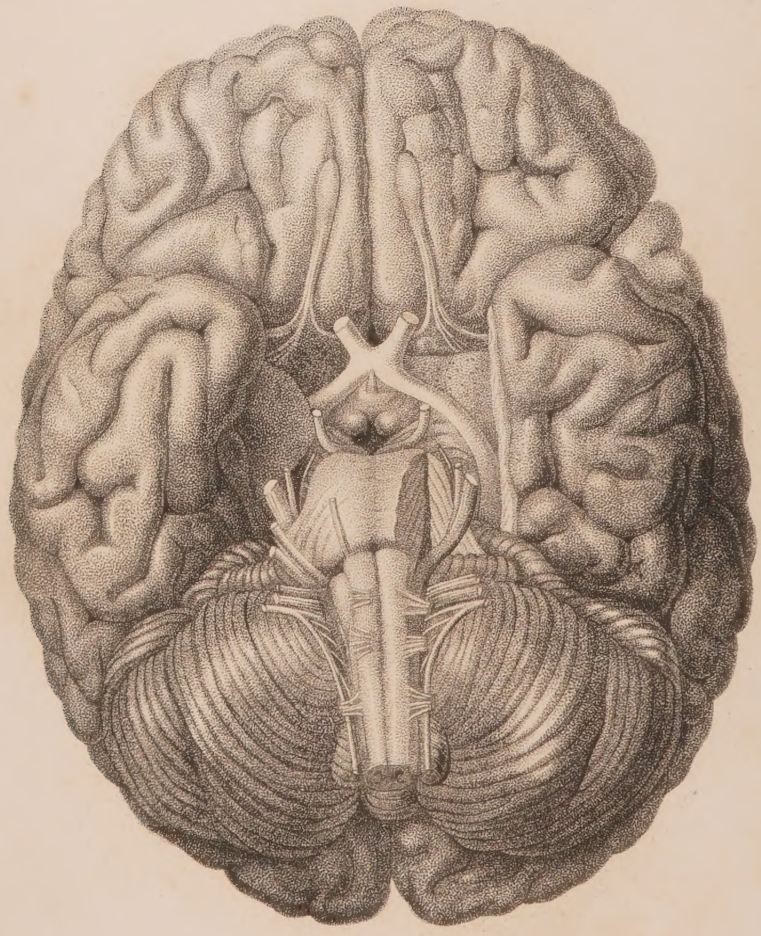


MEDICAL SOCIETY OF LONDON
Established
1773
11 CHANDOS ST. CAVENDISH SQ.

BASE OF THE BRAIN

AND

ROOTS OF THE CEREBRAL NERVES.



H. Adlard, sc.

3
J. CHANDOS ST. CAVENDISH SQ.

A

MANUAL FOR STUDENTS

PREPARING FOR

EXAMINATION AT APOTHECARIES' HALL,

OR

OTHER MEDICAL EXAMINATIONS.

BY JOHN STEGGALL, M.D.

LICENTIATE OF THE ROYAL COLLEGE OF PHYSICIANS, LONDON,
M.R.C.S. ETC.

NINTH EDITION.



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TO

JONATHAN PEREIRA, ESQ. F.R.S.

LECTURER ON CHEMISTRY, MATERIA MEDICA,

&c. &c.

THIS PUBLICATION

IS DEDICATED,

BY HIS VERY SINCERE AND ADMIRING FRIEND,

JOHN STEGGALL.

29, *Bloomsbury-square.*

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PREFACE.

ANOTHER edition of this work having been called for, in a shorter space of time than could have been contemplated, the author has endeavoured to render it still more acceptable to medical students, by extending almost every department. He wishes to direct the attention of the reader to the difference between the atomic numbers mentioned under the Chemical Decompositions and those which are given in the Chemical Notes. In the first, they are arranged so as to conform with the numbers employed by Mr. Phillips; in the Chemical Notes, the atomic equivalents are in accordance with those adopted in Dr. Turner's Chemistry, being the last agreed upon by chemists, and presumed to be the most accurate. The difference, however, is not great; and, indeed, in most instances, is merely fractional. The part on Materia Medica is diminished in quantity, and is intended to be simply a guide to the doses and classes and orders of the drugs, as

the subject has been more fully treated of in a separate work, in consequence of the importance attached to it at the various examinations in Great Britain.

The anatomical part comprises an outline of the whole nervous system; and any deficiencies which may be discovered in the visceral anatomy will be found to be supplied in a work which the author has in the press, viz. "A Manual for the College of Surgeons."

In conclusion, the author trusts that the student will look upon this work in the light which is intended, and not flatter himself that the information contained in it will be a sufficient fund to conduct him through the difficulties of a medical examination.

REGULATIONS, &c.

FOR EXAMINATION AT APOTHECARIES' HALL.

Every Candidate for a certificate to practise as an Apothecary, will be required to produce testimonials :

Of having served an apprenticeship of not less than five years to an Apothecary.

No gentleman practising as an Apothecary in *England* or *Wales* can give his apprentice a legal title to examination, unless he is himself legally qualified to practise as an Apothecary, either by having been in practice prior to or on the 1st of August, 1815, or by having received a certificate of his qualification from the Court of Examiners. An apprenticeship for not less than five years to Surgeons practising as *Apothecaries* in Ireland and Scotland, gives the apprentice a title to be admitted to examination.

Of having attained the full age of twenty-one years :

As evidence of age, a copy of the baptismal register will be required in every case where it can possibly be procured.

Of good moral conduct :

A testimonial of moral character from the gentleman to whom the Candidate has been an apprentice, will always be more satisfactory than from any other person.

And of having pursued the following course of Medical Study during not less than three winter and two summer sessions: the Winter session being understood to extend from the 1st of October to the middle of April, with a recess of fourteen days at Christmas, and the Summer session, from the 1st of May to the 31st of July.

First Winter Session.	Chemistry. Anatomy and Physiology. Anatomical Demonstrations. Materia Medica and Therapeutics.
First Summer Session.	Botany; And such other branches of study as may improve the student's general education.
Second Winter Session.	Anatomy and Physiology. Anatomical Demonstrations. Dissections. Principles and Practice of Medicine.
Second Summer Session.	Botany, if not attended during the first Summer Session. Forensic Medicine.
Third Winter Session.	Dissections. Principles and Practice of Medicine.

MIDWIFERY.

Midwifery, and the Diseases of Women and Children, two courses of Sixty Lectures each, in separate Sessions, and subsequent to the termination of the first Summer Session.

Practical Midwifery, at any time after the conclusion of the first course of Midwifery Lectures.

MEDICAL PRACTICE.

The Student must attend Medical Practice during the full term of eighteen months; the first twelve months, i.e. from the commencement of the Second Winter Session, to the commencement of the third Winter Session, at a recognised hospital; and the remaining six months either at a recognised Hospital, or a recognised Dispensary.

The lectures on Botany may be attended during any Summer Session, either previous or subsequent to the first Winter Session.

The sessional course of instruction in each subject of study, is to consist of not less than the following number of Lectures, viz.:

One hundred on Chemistry.
One hundred on Materia Medica and Therapeutics.
One hundred on the Principles and Practice of Medicine.
Sixty on Midwifery, and the Diseases of Women and Children.
Fifty on Forensic Medicine.
Fifty on Botany.

The number of Lectures on Anatomy and Physiology, and of Anatomical Demonstrations, must be in conformity with the regulations of the Royal College of Surgeons of London, on these subjects.

The Lectures required in each course, must be given on separate days. An Examination of an hour's duration will be deemed equivalent to a Lecture.

Students, when they present themselves for examination, must bring testimonials of having received instruction in Practical Chemistry during their attendance upon the Lectures on Chemistry, Materia Medica, or Forensic Medicine; and also of having attended a full Course of Clinical Lectures, and such instruction in Morbid Anatomy, as may be afforded them during their attendance at an Hospital.

Every Student will be required to bring a testimonial of having dissected the whole of the human body once at least.

The above course of study may be extended over a longer period than three Winter and two Summer sessions, provided the Lectures and Medical Practice are attended in the prescribed order, and in the required sessions.

Students whose attendance on Lectures commenced prior to the 1st of February, 1828, will be admitted to examination in

conformity with the Regulations published in September, 1826, viz. after an attendance on

One Course of Lectures on Chemistry.
One Course of Lectures on Materia Medica,
Two Courses of Lectures on Anatomy and Physiology.
Two Courses of Lectures on the Theory and Practice of Medicine.
And six months' Physician's Practice at an Hospital, or nine months at a Dispensary.

Those who began to attend Lectures subsequently to the 1st of February, 1828, and previously to the 1st of October of the same year, in conformity with the Regulations of September, 1827, viz. after an attendance on

One Course of Lectures on Chemistry.
One Course of Lectures on Materia Medica and Botany.
Two Courses of Lectures on Anatomy and Physiology.
Two Courses of Lectures on the Theory and Practice of Medicine; these last having been attended *subsequently* to the Lectures on Chemistry and Materia Medica, and to one course at least of Anatomy.
And six months, at least, Physician's Practice at an Hospital, or nine months at a Dispensary; such Attendance having commenced *subsequently* to the termination of the first Course of Lectures on the Principles and Practice of Medicine.

Those whose attendance on Lectures commenced in October, 1828, must have complied with the Regulations of September, 1828, viz. by having attended

Two Courses of Lectures on Chemistry.
Two Courses of Lectures on Materia Medica and Botany.
Two Courses of Lectures on Anatomy and Physiology.
Two Courses of Anatomical Demonstrations.
Two Courses of Lectures on the Theory and Practice of Medicine: these last having been attended *subsequently* to one Course of Lectures on Chemistry, Materia Medica, and Anatomy.
And six months, *at least*, the Physician's Practice at an hospital, (containing not less than sixty beds,) or nine months at a Dispensary: such attendance to have commenced *subsequently to the termination* of the first course of Lectures on the Principles and Practice of Medicine.

All Students who began to attend Lectures in January, 1829, are required to have attended the Physician's Practice at an Hospital for nine months, or at a Dispensary for twelve months, and also to have attended

Two Courses of Lectures on Midwifery and the Diseases of Women and Children.

Students whose attendance on Lectures commenced on or after January, 1831, must adduce proof of having devoted at least two years to attendance on Lectures and Hospital Practice; and of having attended the following Courses of Lectures:

Chemistry:	Two Courses—Each Course consisting of not less than Forty-five Lectures.
Materia Medica and Therapeutics:	Two Courses—Each Course consisting of not less than Forty-five Lectures.

Anatomy and Physiology:	Two Courses:	Of the same extent as required by the Royal College of Surgeons of London.
Anatomical Demonstrations:	Two Courses:	
Principles and Practice of Medicine.		Two Courses—Each Course consisting of not less than Forty-five Lectures,—To be attended subsequently to the termination of the first Course of Lectures on Chemistry, Materia Medica, and Anatomy and Physiology.
Botany:		One Course—Consisting of not less than Thirty Lectures,—To be attended between the 1st of April and 31st of October.
Midwifery: and the Diseases of Women and Children;		Two Courses.
Forensic Medicine:		One Course—To be attended during second year.

Students are likewise *earnestly* recommended to avail themselves of instruction in *Morbid Anatomy.*

The Candidate must also have attended, for Twelve Months, at least, the Physician's Practice at an Hospital containing not less than sixty beds, and where a Course of Clinical Lectures is given; or for Fifteen Months at an Hospital where Clinical Lectures are not given; or for Fifteen Months at a Dispensary connected with some Medical School recognised by the Court. No part of this attendance can be entered upon until the termination of one entire year from the commencement of attendance on Lectures, nor until one course of Lectures, at least, on Chemistry, Materia Medica, Anatomy, and the Practice of Medicine, has been attended in the order prescribed by the Regulations.

TESTIMONIALS.

The Testimonials of attendance on Lectures, and Medical Practice must be given on a printed form, with which Students will be supplied, on application, at the under-mentioned places:

In London, at the Beadle's Office, at this Hall.

In Edinburgh, at Messrs. Maclachlan and Stewart's, booksellers.

In Dublin, at Messrs. Hodges and Smith's, booksellers.

In the provincial towns, where there are Medical Schools, from the gentlemen who keep the Registers of the Schools.

No other form of Testimonial will be received; and no attendance on Lectures will qualify a Candidate for examination, unless the Lecturer is recognised by the Court.

The names of the Lecturers recognised by the Court, may be seen on application to the several Gentlemen acting as Regis-

trars in the Provincial Schools, and at the Beadle's Office at the Hall.

The Teachers in London, Dublin, Edinburgh, Glasgow, and Aberdeen, recognised by the constituted Medical Authorities in those places respectively, are recognised by the Court; and Certificates given by the Medical Professors in Foreign Universities are also recognised and received by the Court.

REGISTRATION.

A book is kept at the Hall of the Society for the Registration, at stated times, of the names of Students, and of the Lectures, Hospitals, and Dispensaries they attend.

All Students in London, are required to appear personally, and to register the several classes for which they have taken Tickets; and those only will be considered to have complied with the regulations of the Court, whose names and classes in the register correspond with the testimonials of the Teachers.

The book will be open for the registration of Tickets authorising the attendance of Students on Lectures and Medical Practice, in the months of October and May; and for the registration of Certificates of having duly attended such Lectures or Medical Practice in the months of April and August. Due notice of the days and hours of registration will be given from time to time.

The Court also require Students at the Provincial Medical Schools to register their names in their own hand-writing, in the order above stated, with the Registrar of each respective school; and the Registrars are requested to furnish the Court of Examiners with a copy of each registration *immediately* after its termination, as those Students only will be admitted to examination whose registrations have been *duly* communicated to the Court.

PRELIMINARY EXAMINATION.

Students may undergo their Latin Examination at any time after their first registration. A book is opened at the Beadle's office at the Hall, for the names of those gentlemen who are desirous of undergoing this Examination, to which twenty will be admitted on each successive Saturday, provided there are as many names on the list; when less than twenty names are on the list, no examination will take place. Candidates must attend at half-past three o'clock, and those who fail to pass this Examination satisfactorily, will not be readmitted until they appear for their general Examination.

EXAMINATION.

Every person intending to offer himself for examination must give notice in writing to the Clerk of the Society, on or before the Monday previously to the day of Examination, and must also at the same time deposit all the required Testimonals at the office of the Beadle, where attendance is given every day, except Sunday, from *Nine* until *Two* o'clock.

The examination of the Candidate for a certificate of qualification to practise as an Apothecary, will be as follows:

In translating portions of the first four books of Celsus de Medicinâ, and of the first twenty-three chapters of Gregory's Conspectus Medicinæ Theoreticæ:

In Physicians' Prescriptions, and the Pharmacopœia Londinensis:

In Chemistry:

In Materia Medica and Therapeutics:

In Botany:

In Anatomy and Physiology:

In the Principles and Practice of Medicine. This branch of the examination embraces an inquiry into the pregnant and puerperal states; and also into the diseases of children.

The examination of a Candidate for a certificate of qualification to act as an Assistant to an Apothecary, in compounding and dispensing medicines, will be as follows:

In translating Physicians' Prescriptions, and parts of the Pharmacopœia Londinensis:

In Pharmacy and Materia Medica.

By the 22d section of the Act of Parliament, no rejected Candidate for a certificate to practise as an Apothecary, can be re-examined *until the expiration of six months* from his former examination; and no rejected Candidate as an Assistant *until the expiration of three months.*

The Court meet in the Hall every Thursday, where Candidates are required to attend at a Quarter before Four o'clock.

For information relative to these Regulations, Students are referred to Mr. Sayer, Apothecaries' Hall, every day (Sunday excepted), between the hours of Nine and Two o'Clock; and for information on all other subjects connected with the "Act for better regulating the Practice of Apothecaries," application is to be made to Mr. R. B. Upton, Clerk of the Society, at the Hall every day (Sunday excepted), between the hours of Nine and Ten.

It is expressly ordered by the Court of Examiners, that no gratuity be received by any officer of the Court.

Students will particularly oblige the Author by immediately making with a pen the following

CORRIGENDA:

Page 89	*line* 11		*for* oxygen	*read* acid.	
102	11		iodine	oxygen.	
201	1		hydro-sulphuret	hydro-sulphuric acid.	
—	13		*copper ;* with	copper and	
242	11		*after* hydrochloric	*insert* acid.	
264	5	*(from bottom)*	*for* gr. j. to gr. iij.	*read* gr. ½ to gr. j.	
269	20	*(from top)*	Monand.	Monad.	
270	19		Creastoon	Creasoton.	
277	24		℥j. to ℥iij.	gr. j. to gr. iij.	
313	9	*(from bottom)*	*for* to the fourth ventricle.	from the lateral ventricles.	
470	4		above	about.	

CHEMICAL DECOMPOSITIONS,

&c.

ACETUM DESTILLATUM.

By distilling vinegar, acetic acid, with water and a little alcohol, pass over in the first seven pints into the receiver, leaving the heavy impurities in the retort. If the heat were continued, the acetic acid would be coloured, and obtain an empyreumatic odour, resulting from decomposition of mucilaginous matter.

Vinegar is made either from malt-liquors, or weak wines, or various fruits, such as gooseberries, &c. Hence it contains, amongst its impurities, mucilage, colouring matter, a little alcohol, sometimes malic or tartaric acid; and in our own country we find sulphuric acid, on account of the law allowing one part of it to be added to 1000 parts of vinegar. We also find in vinegar, on some occasions, metallic impregnations, as of copper, lead, and tin, arising from the vessels which have been employed in preparing it. They may be discovered by their appropriate tests. The

strongest vinegar contains about 5 per cent. of real acetic acid, and a fluid ounce of it should be saturated by 58 grains of carbonate of soda. When a solution of chloride of barium is added to an ounce of vinegar, the precipitated sulphate of baryta should not exceed 1·14 grains. Should hydrosulphuric acid occasion no precipitate, it proves the absence of metallic salts. *Distilled vinegar* should not be discoloured by hydrosulphuric acid or ammonia; and no precipitate should be occasioned by acetate of lead, iodide of potassium, or nitrate of silver. Silver leaf, added to the solution, ought to afford no precipitate on the addition of hydrochloric acid. These reagents refer to the possible presence of metallic salts generally, sulphuric acid, acetate of lead, hydrochloric acid, and nitric acids. Hydrosulphuric acid would cause a dark precipitate, if tin, lead, or copper were present. Ammonia would turn the liquid blue if copper existed in it; acetate of lead would yield a white precipitate with sulphuric acid; iodide of potassium would throw down a yellow precipitate if lead were in the liquid; nitrate of silver, throwing down a white precipitate, would indicate the presence of hydrochloric acid. If nitric acid existed in this acid, it would oxidize and dissolve silver, which would form a white chloride on the addition of hydrochloric acid.

13 grains of crystallized carbonate of soda are saturated by 100 grains of this acid.

Medical Uses. Vinegar is refrigerant, and considered to be antiseptic. It is seldom used much internally. Dr. Thomson recommends it

during the administration of acetate of lead; with the idea of preventing that salt being converted into a carbonate. It is often used in the form of vapour in sore throats; externally, in lotions, for sponging the chest in some pulmonary diseases, or the body generally in fever. In the latter disease it is often sprinkled about rooms, with the impression that it has disinfecting qualities.

Distilled vinegar is employed in pharmacy to form the acetates, all of which are very soluble in water.

Dose. ʒj. to ℥ss. of vinegar.

Prep. Acetum Colchici, Acetum Scillæ, Liq. Ammoniæ Acetatis, Oxymel Scillæ.

ACIDUM ACETICUM.

Ingredients:

Acetate of soda,
Sulphuric acid,
Distilled water.

Decomposition. The sulphuric acid, from its greater affinity, unites with the soda, forming sulphate of soda; the acetic acid is set free, and is separated by distillation. The heat should not be urged too long, for fear of decomposing even the sulphate of soda.

Acetate of soda is obtained in the following manner: — By submitting wood to destructive distillation, an acid, named pyroligneous or acetic, is generated, contaminated with tarry matter. To

this lime is first added, to form an acetate of lime; then sulphate of soda; when double decomposition ensues, affording acetate of soda and sulphate of lime. The soluble acetate is removed, and heated so as to expel the tarry matter, and repeatedly dissolved and crystallized, until quite pure.

This acetic acid has a specific gravity of 1.048. It is very volatile: when heated its vapour is combustible; 100 grains of it saturate 87 grains of crystals of carbonate of soda. It contains 30 per cent. of real acid.

Anhydrous acetic acid is composed of:

3 oxygen	3×8	$= 24$
3 hydrogen	3×1	$= 3$
4 carbon	4×6	$= 24$
	Atomic number	51

Medical Uses. This liquid, applied to the skin, acts as a rubefacient, and even raises a blister. It is also a mild escharotic. It is chiefly employed in pharmacy.

Prep. Acetum Cantharidis, Acetas Morphiæ, Acetas Plumbi, Acetas Potassæ, Oxymel.

ACETUM CANTHARIDIS.

This is a very useful preparation for producing speedy vesication: a piece of linen moistened with it is a convenient mode of applying it. It will often produce a blister in half an hour. It is not intended for internal administration.

ACETUM COLCHICI.

The proportion of the cormus to the liquid, is one ounce to seventeen ounces. According to some German chemists, the alkaline principle is not veratria, but a distinct substance, which they name Colchicia; therefore we have the acetate of colchicia in solution. This vegetable alkali is best procured from the seeds of colchicum.

Medical Properties. Diuretic, purgative, diaphoretic, and sedative; most used in gout and rheumatism. It does not agree with the stomach so well as the vinum colchici.

Dose. ʒj. to ʒij.

ACIDUM BENZOICUM.

By the application of heat to benzoin, benzoic acid rises, and condenses in the upper part of the apparatus. It is afterwards pressed between bibulous paper, to separate some oil which proceeds from decomposition of a portion of the resin. The acid is a second time sublimed.

Benzoin is not a gum-resin, but a compound of benzoic acid and resin, with a small quantity of a powerful aroma. We usually procure about 12 per cent. of acid from it. Benzoic acid may also be obtained by boiling benzoin in water, with car-

bonate of lime. The benzoate thus formed is decomposed easily by hydrochloric or sulphuric acid; and the benzoic acid, from its sparing solubility, falls. It requires 200 times its weight of cold water for solution. When properly prepared, it should easily be volatilized by heat, readily dissolved by alcohol, sparingly by water; soluble in a solution of potash or lime, and be precipitated from such solutions by hydrochloric acid.

Benzoic acid is a compound of a principle named benzule and oxygen, and cannot exist uncombined with water. The composition of the anhydrous acid is:

14 carbon	$14 \times 6 =$	84
5 hydrogen	$5 \times 1 =$	5
3 oxygen	$3 \times 8 =$	24
		113
The crystals contain one water		9
Atomic number		122

Medical Properties. It is of no essential service as a medicine. Some imagine it to be a stimulating expectorant, and antispasmodic. It is most used on account of its odour.

Prep. Tinct. Camphoræ Comp.

ACIDUM CITRICUM.

Ingredients:

Lemon juice,
Prepared chalk,
Dilute sulphuric acid,
Distilled water.

Decomposition. In procuring this acid, the citric acid of the lemon-juice first combines with the lime, forming an insoluble citrate of lime, and carbonic acid is disengaged. The citrate of lime is then decomposed by sulphuric acid, which unites with the lime, forming a comparatively insoluble sulphate of lime, and soluble citric acid is set free, and obtained in crystals by evaporation.

The object of this process is to separate the pure acid from the mucilage, which is washed away when the lime has united with the citric acid. The quantity of acid obtained from lemon-juice is about 11½ ..rs. from a pint. The saturating power of citric acid with the alkalies usually employed, may be seen by the following table:

			citric acid.	lemon-juice.
℈j. of bicarbonate of potash	requires		gr. 14	℥iijss.
℈j. of carbonate of potash	for		gr. 17	℥ss.
℈j. sesquicarbonate of ammonia	saturation		gr. 24	℥vj.

Composition of anhydrous citric acid:

2 hydrogen	2 × 1 =	2
4 oxygen	4 × 8 =	32
4 carbon	4 × 6 =	24
		58

The crystals contain rather more than one equivalent of water, making its atomic number, according to Mr. Phillips, 70.

Citric acid should be quite soluble in water. If the precipitate occasioned by adding acetate of lead to its solution is not soluble in dilute nitric acid, it would indicate the presence of sulphuric acid. The tartrate amongst the salts of potash,

alone gives a precipitate with it, which is supertartrate of potash, with a citrate of potash in solution. If it be not entirely decomposed and dissipated by heat, some impurity is present.

Medical Properties. Refrigerant and sedative, always given in combination with some alkali. It is preferable to tartaric acid, when we wish the neutral salt not to relax the bowels.

Dose. ℈j.; of lemon juice, ʒss.

HYDROCHLORIC ACID.

Ingredients:

Chloride of sodium,
Sulphuric acid,
Distilled water.

Decomposition. When the chloride of sodium, the acid, and half the water, are heated together, the water and the chloride are decomposed, the oxygen of the water combining with the sodium, forms soda; this, with the sulphuric acid, forms sulphate of soda; the hydrogen combining with the chlorine, forms hydrochloric acid gas, which passes over into the receiver, where it is absorbed by the water placed there for that purpose; sulphate of soda remains in the retort.

This liquid is a solution of hydrochloric acid gas in water; water can absorb 480 times its volume of this gas.

The tests of its purity are the following: it should be free from colour, and, by heat, entirely pass into vapour. It should yield no precipitate on the addition of chloride of barium, ammonia, or sesquicarbonate of ammonia. Gold is not affected by it. It does not remove the colour of sulphate of indigo. Its specific gravity is 1·160. 132 grains of crystals of carbonate of soda are saturated by 100 grains of it. When this acid is coloured, the impurities are either iron or free chlorine. The chlorine is detected by the gold, which would be dissolved in it if present; also, by sulphate of indigo, which would lose its colour. If chloride of barium produces a precipitate, it shows the presence of sulphuric acid; ammonia and its sesquicarbonate are employed to precipitate any metals. The presence of iron may be discovered by the ferro-cyanide of potassium, which throws down Prussian-blue.

Composition of this acid:

1 chlorine	= 36
1 hydrogen	= 1
Atomic number	37

Medical Properties. Tonic and antiseptic. It is given with benefit in typhoid fevers, and scarlatina; in the treatment of worms, and in cases of abundance of the earthy phosphates in the urine. It has been erroneously supposed to be a solvent for all urinary calculi; although it may not be able to dissolve calculi in the bladder, through the medium of the circulation, still it has the power of arresting their rapid increase. It is also very

useful as a gargle, when considerably diluted, in putrid sore throats.

Dose. ♏. v. to ♏. xv.

ACIDUM HYDROCYANICUM DILUTUM.

Ingredients:

Ferrocyanide of potassium,
Sulphuric acid,
Distilled water.

Decomposition. In this process water is decomposed; its oxygen combining with potassium, forms potash, which the sulphuric acid immediately seizes upon, forming bisulphate of potash; the hydrogen, uniting with cyanogen, forms hydrocyanic acid, which, by the heat, is driven into the receiver; and we have remaining in the retort a white salt, consisting of 1 equivalent of cyanide of potassium, and 2 of cyanide of iron.

This acid is ordered to be kept from the light, in consequence of readily undergoing decomposition. From being colourless, it turns somewhat brown, and affords subsequently a blackish deposit, a compound of carbon, hydrogen, and nitrogen, named azulmic acid; and we find ammonia in the water.

In the second formula, in which hydrochloric acid and cyanide of silver are employed, there is mutual decomposition; the chlorine goes over to

the silver, and the hydrogen to the cyanogen, forming hydrocyanic acid, which is held in solution, and subsequently poured off from the precipitated chloride of silver.

The tests of its purity are these: It is colourless, and entirely vaporizable by heat, with a peculiar odour. It slightly reddens litmus paper, and being volatile, the red colour so produced soon disappears. It is not coloured by hydrosulphuric acid. In 100 grains of this acid, nitrate of silver, added, precipitates 10 grains of cyanide of silver, which are readily dissolved in hot nitric acid. Some other acid is present if a red precipitate falls, on the addition to it of the iodo-cyanide of potassium and mercury. Two grains of real hydrocyanic acid are contained in 100 grains of this dilute acid.

By its volatility we ascertain the absence of solid matter. Hydrosulphuric acid not discolouring it, shows the absence of metallic salts. By the nitrate of silver its strength is ascertained; and the cyanide being dissolved by nitric acid, shows that it is not the chloride. If any other acid be present when the iodo-cyanide of potassium and mercury is added, there will be a red precipitate of biniodide of mercury.

Composition of the anhydrous acid :

1 hydrogen = 1
1 cyanogen = 26

Atomic number 27

Medical Properties. Powerfully sedative. It diminishes the heart's action, and also that of vessels in parts, which it can readily be applied

to. Thus it checks vomiting in irritation or in subacute inflammation of the stomach; is useful in dyspepsia, depending on the preceding causes. It is given in asthma, hooping-cough, phthisis, and in coughs generally; it has been applied successfully to the surface of the body, in the treatment of some skin diseases.

Dose. 5 minims, carefully increased.

NITRIC ACID.

Ingredients:

Nitrate of potash,
Sulphuric acid.

Decomposition. The sulphuric acid combines with the potash, forming bisulphate of potash, and the disengaged nitric acid is driven by the heat into the receiver.

The acid is used in excess, in order to supply a sufficient quantity of water to form liquid nitric acid, and to prevent the disengagement of nitrous acid. Should any nitrous acid be present, it can readily be expelled by heat.

Tests of its Purity. It entirely passes into vapour by heat. If nitrate of silver causes no precipitate, it shews the absence of hydro-chloric acid. The chloride of barium causing no precipitate, shews that sulphuric acid is not present. Its specific gravity is 1.500; 217 grains of the crystals of carbonate of soda are saturated by 100 grains of this acid.

Composition:

5	oxygen	5 × 8 =	40
1	nitrogen		14
1½	water		13.5
			67.5

The liquid acid was formerly stated to contain 2 equivalents of water.

Medical Properties. Tonic and antiseptic. It has been much used, largely diluted, as a drink in typhoid fevers; in which, like most other acids, it act by its sedative or anti-phlogistic properties; and, by restoring the circulation to its proper standard, becomes also tonic. It has been much and successfully employed in syphilis, when mercury was inadmissible. It is applied externally to fetid ulcers, in the quantity of 15 minims to a pint of water; and has been given internally in calculous affections, where the phosphates are predominant.

Its vapour has been used to prevent or destroy contagion: hence it is often employed in purifying gaols, hospitals, ships, &c. This is done by pouring sulphuric acid on nitrate of potash.

Nitric acid is also used occasionally as an escharotic. Dropped into a hollow tooth, it is singularly efficacious in arresting that agonizing pain, toothach.

DILUTE NITRIC ACID.

This is made by mixing 1 ounce of nitric acid with 9 ounces of water.

Dose. 20 to 60 minims.

ACIDUM PHOSPHORICUM DILUTUM.

Ingredients:

Phosphorus,
Nitric acid,
Distilled water.

Decomposition. Nitric acid is decomposed, giving oxygen to the phosphorus to form phosphoric acid, binoxide of nitrogen being evolved: the acid is dissolved in the water.

Composition of phosphoric acid:

5 oxygen	5 × 8	= 40
2 phosphorus	2 × 16	= 32
		72

or according to some 36.

Tests of its Purity. If chloride of barium and nitrate of silver produce precipitates insoluble in nitric acid, it is evident from the first that sulphuric acid is present; from the second, hydro-chloric; —the precipitates being sulphate of baryta or chloride of silver. Plates of copper or silver if acted on, would indicate the presence of nitric acid, and hydro-sulphuric would produce a precipitate if metallic salts were in the acid liquid. The sp. gr. of this liquid is 1.064, and 42 grains of the crytals of carbonate of soda saturate 100 grains of this acid, without any precipitation, which shews that no phosphate insoluble in water was held in solution by excess of acid.

Medical Properties. It is said to be tonic, and very serviceable in cases of exostosis, on which this acid is supposed to act chemically, that is, rendering the phosphate of lime soluble, and thereby diminishing it, if disposed to accumulate.

Dose. ♏. xx. to ʒi.

ACIDUM SULPHURICUM DILUTUM.

Composition. One ounce and a half of sulphuric acid, and fourteen ounces and a half of water.

Sulphuric acid is obtained by burning a mixture of nitrate of potash and sulphur in large chambers lined with lead, with water at the bottom. One atom of the sulphur combines with two atoms of oxygen of the air, forming sulphurous acid, which is disengaged; another atom of the sulphur decomposes the nitric acid of the potash, and, uniting with three atoms of its oxygen, forms sulphuric acid; this combining with the potash of the nitrate, forms sulphate of potash, which is left in the earthen pot. The nitrogen, and two atoms of the oxygen of the acid, form the binoxide of nitrogen, or nitrous gas, which, escaping into the air of the chamber, abstracts from it two atoms of oxygen, and then becomes nitrous acid. The sulphurous and nitrous acids, by meeting in the chamber, decompose each other, forming a crystalline solid, composed of sulphuric acid, hyponitrous acid, and watery vapour. When this solid is received

by the water in the chamber, it is, in its turn, decomposed; the water retains the sulphuric acid, but the hyponitrous acid is resolved into nitrous acid and binoxide of nitrogen, which fly off with effervescence, and again attract fresh oxygen to combine with the sulphurous acid, which in the interim has been evolved. When the water is sufficiently acidulated, it is drawn off and heated until it becomes of a proper specific gravity.

Sulphuric acid is seldom quite pure: it generally contains a small quantity of sulphate of potash and lead, the latter of which is often seen in the form of a white flocculent precipitate, when the acid is diluted with water.

By mixing four parts of sulphuric acid with one of water, such condensation of volume takes place as to evolve heat of the temperature of 300 degrees.

Composition of the anhydrous acid:

3 oxygen	3×8	$= 24$
1 sulphur		$= 16$
		40
The liquid acid contains		
1 water		$= 9$
		49

Medical Properties. Tonic, refrigerant, and antiseptic. This acid is frequently given to check the night sweats in phthisis; with vegetable bitters after fevers, and especially with the sulphate of quinine and other preparations of cinchona. It is useful in most hæmorrhages, acting as an astringent and sedative; and has been added to ointments, to make a stimulating application.

Dose. Of the diluted acid, from 10 to 20 minims.

ACIDUM TARTARICUM.

Ingredients:

Bitartrate of potash,
Boiling water,
Prepared chalk,
Dilute sulphuric acid,
Hydrochloric acid.

Decomposition. When the bitartrate and half the chalk are boiled in water they are both decomposed, the bitartrate surrendering one equivalent of its acid to the lime, forming a tartrate of lime, which falls to the bottom; carbonic acid escapes, and a tartrate of potash remains in solution. The solution of tartrate of potash, instead of being rejected, is preserved to yield its tartaric acid also. This is accomplished by adding the hydrochloric acid to the rest of the chalk ordered, when decomposition ensues; the chlorine with the calcium forms a chloride of calcium in solution, the hydrogen of the acid and oxygen of the lime form water, and carbonic acid is evolved; on the addition of this solution of chloride of calcium to the solution of tartrate of potash, fresh chemical changes occur; the chloride of calcium and tartrate of potash decompose each other; the chlorine with potassium forms a chloride of potassium, the oxygen of the potash passes to the lime, with which the tartaric acid combines, forming tartrate of lime. In this way the tartaric acid is all transferred from the potash to the lime; when

sulphuric acid is added to the washed tartrate of lime, sulphate of lime is formed, and tartaric acid is set free, and, by evaporation, is procured in crystals.

Tests of its Purity. It is totally soluble in water; this solution produces a precipitate of bi-tartrate, with any neutral salt of potash. If the precipitate produced in this solution by acetate of lead is insoluble in dilute nitric acid, it indicates that sulphuric acid in some form is present.

Composition:

4 carbon	4×6	$= 24$
5 oxygen	5×8	$= 40$
2 hydrogen	2×1	$= 2$
	Atomic number ...	66

The crystallized acid contains one equivalent of water. Atomic number, 75.

Medical Properties. Refrigerant, and, with alkalies in the form of neutral salt, mildly purgative. It is much employed as an ingredient in soda powders, to combine with the soda, and disengage carbonic acid; it is also a constituent of Seidlitz powders. Its saturating power is nearly the same as of citric acid.

Dose. ℈j. to ʒss.

ÆTHER SULPHURICUS.

Ingredients:

Rectified spirit,
Sulphuric acid,
Carbonate of potash, previously heated.

Decomposition. When the acid and spirit are heated together, two equivalents of anhydrous sulphuric acid combine with two equivalents of alcohol to form sulphovinic acid. By the continuance of the heat, this acid is resolved into two equivalents of anhydrous sulphuric acid, one of water, and one of æther; the latter of which, by heat, passes over into the receiver, and we have left in the retort the two equivalents of sulphuric acid with three of water. The above is the explanation of Mr. Hennell. This liquid is also named a dihydrate of olefiant gas, a hydrate of ætherine, and by Dr. Kane, a protoxide of æthereum. Another mode of explaining the formation of æther, but admitted to be inaccurate, is that the sulphuric acid by its affinity for water, abstracts from two equivalents of alcohol, one equivalent of hydrogen and one of oxygen; that is, in the proportion for forming water; so that æther may be said to be a compound of two equivalents of olefiant gas, and one of water, whilst alcohol contains one of each.

Qualities. Sp. gr. .750. Exposed to the air, it entirely passes into vapour. Æther of the shops

varies in specific gravity from .733 to .765. It slightly reddens litmus paper; it combines very sparingly with water, in the proportion of an ounce to a pint, and remains transparent.

Composition:

4 carbon	4 × 6 =	24
5 hydrogen	5 × 1 =	5
1 oxygen	=	8
Atomic number ...		37

Medical Properties. A diffusible stimulant and antispasmodic. It is often prescribed in low states of the system with benefit; it is useful in hysteria, and asthma, and during the passage of biliary calculi, has been supposed not only to diminish pain, but likely to act as a solvent to the concretion. By its evaporation, considerable cold is produced; therefore, it is usefully introduced into cooling external applications.

Dose. ʒss. to ʒiss.

OLEUM ÆTHEREUM.

Ingredients:

Rectified spirit,
Sulphuric acid,
Solution of potash,
Distilled water.

Decomposition. The excess of acid in this preparation prevents the formation of æther only, the products being some æther, an oily liquid, sulphurous acid and water; by exposing the supernatant liquid to the air for a day, the æther passes off in vapour, leaving the oily liquid behind; this is to be treated with solution of potash and water, to remove any sulphurous acid, and the residue is named æthereal oil, or oil of wine.

Brande and Turner consider this liquid to be a compound of

1 sulphuric acid	= 40
1 æther	= 37
Atomic number	77

The acid is intimately combined with the æther, as it affords no precipitate with chloride of barium, unless heat be applied to decompose the oil.

Qualities. It has a peculiar odour; is in a very slight degree acrid; is quite soluble in sulphuric æther, and has no acid reaction. Sp. gr. 1.050.

Medical Properties. The same as those of sulphuric æther: it is not given alone, but in the form of the spiritus ætheris sulphurici compositus.

SPIRITUS ÆTHERIS NITRICI.

Ingredients:

Nitric acid,
Rectified spirit.

Decomposition. The nitric acid and alcohol are both decomposed. The acid is resolved into hyponitrous acid and oxygen, and the alcohol is converted into æther; the oxygen of the acid combining with the disengaged elements of the alcohol, forming water, carbonic acid, malic, acetic, and tartaric acids. The nitric æther which is distilled over may be considered to be a hyponitrite of æther, with uncombined alcohol.

If the specific gravity exceeds .834, it is probable that nitric acid or water in excess are present. The litmus being strongly reddened, proves an abundance of acid, as also the effervescence occasioned by the carbonate of soda.

Composition:

1 hyponitrous acid	= 38
1 æther	= 37
Atomic number ...	75

Medical Properties. Diffusible stimulant, and diuretic.

Dose. ʒs. to ʒij.

SPIRITUS ÆTHERIS SULPHURICI COMPOSITUS.

A mixture of sulphuric æther, rectified spirit, and æthereal oil.

The advantage of this preparation is, that it is miscible with water, and therefore more convenient for internal administration.

Dose. ʒss. to ʒij.

ACONITINA.

Ingredients:

Aconite root,
Rectified spirit,
Dilute sulphuric acid,
Solution of ammonia,
Animal charcoal.

Decomposition. By boiling the root with spirit, the aconitine with its acid is dissolved; and by distillation, this liquid is reduced to the thickness of an extract. When the sulphuric acid is added, it combines with the aconitine, and holds it in solution. To this ammonia is dropped, to abstract the acid, and precipitate the aconitine, which is collected and mixed with animal charcoal, to decolorize it. It is again combined with dilute sulphuric acid, and again precipitated by ammonia, and is ultimately procured in a pure form. Aconitina is a vegetable alkali; it is more soluble in sulphuric æther, less so in spirit, and very slightly in water.

The vegetable alkalies or alkaloids are compounds of carbon, oxygen, hydrogen, and nitrogen.

Medical Properties. A powerful anodyne, and narcotic remedy. It has been used successfully in some painful neuralgic affections, in very minute doses. It is chiefly used externally in the form of an ointment or alcoholic solution.

Dose. Gr. $\frac{1}{20}$, to be very carefully increased.

AMMONIÆ SESQUICARBONAS.

Ingredients:

Hydrochlorate of ammonia,
Chalk.

Decomposition. When heated together, the hydrochloric acid and lime of the chalk are decomposed; the chlorine of the acid combines with the calcium, forming chloride of calcium; the hydrogen of the acid, with the oxygen of the lime, forming water, which rises with the carbonic acid and ammonia, forming hydrated sesquicarbonate of ammonia, chloride of calcium remaining in the retort.

Composition:

$1\frac{1}{2}$ carbonic acid,
1 ammonia,
1 water.

If this preparation could be made in vessels perfectly closed, the ammonia would be a carbonate, instead of a sesquicarbonate; during the sublimation, some water escapes, as also ammonia, which accounts for the preponderance of carbonic

acid. Ammonia combines with carbonic acid in three proportions, viz., the monocarbonate, sesquicarbonate, and bicarbonate. The first exists in spiritus ammoniæ; the second in the preparation under notice, and this sesquicarbonate becomes bicarbonate by being kept, and somewhat exposed to the air, which occasions the escape of some more ammonia.

Qualities. Exposed to the air it passes into a powder, and loses some ammonia; it is entirely volatilizable. After being saturated with nitric acid, no precipitate is formed by adding chloride of barium, or nitrate of silver, shewing the absence of sulphuric and hydrochloric acids.

Medical Properties. A diffusible stimulant, antispasmodic, antacid, and somewhat diaphoretic; in large doses emetic. As an emetic it may be of great benefit in narcotic poisoning. This substance is often very serviceable in depressed states of the system, as in typhus, confluent small-pox, &c. &c. It is a stimulant and rubefacient, if applied externally.

Dose. As a stimulant, gr. v. to gr. x.
As an emetic, gr. xx. to gr. xxx.

Prep. Liq. amm. sesquicarb.—Liq. amm. acet.—Cupri ammonio-sulphas.

LIQUOR AMMONIÆ.

Ingredients:

Hydrochlorate of Ammonia,
Lime,
Water.

Decomposition. When the above ingredients are properly mixed and heated, the hydrochloric acid and lime are both decomposed; the chlorine combining with the calcium, forms chloride of calcium; the hydrogen and oxygen form water; by heat, the ammonia, which is set free, passes over with part of the water into the receiver.

Liquor ammoniæ is a solution of ammoniacal gas in water.

Qualities. This liquid emits copious alkaline vapours, which powerfully redden turmeric paper. It is entirely volatilizable; does not produce a precipitate with lime, nor with sesquicarbonate of ammonia or nitrate of silver, after being saturated with nitric acid. Sp. gr. 960. It contains about 10 per cent. of the gas.

It should be recollected, that the more ammonia water absorbs, the lighter is its specific gravity.

The lime water is used to shew the absence of carbonic acid; the sesquicarbonate of ammonia and nitrate of silver to detect any earthy matter, or hydrochloric acid.

Ammoniacal gas is composed of

3 hydrogen	3 × 1 =	3
1 nitrogen		14
Atomic number ...		17

Medical Properties. The same as of the former preparation, and in addition powerfully escharotic. It is not so much given internally. Externally, it is often prescribed as a rubefacient, in the form of embrocations. If, accidentally, too large a dose has been swallowed, the best antidote would be some fixed oil, as almond or olive oil. The acids recommended by some would be too irritating, would be swallowed with difficulty, and would form compounds more injurious than the compound formed with the oil.

Dose. ɱ. x. to ɱ. xx., in milk, or some bland liquid.

Prep. Lin. ammoniæ.—Lin. camph. c.—Lin. hydrargyri.—Spir. amm. succinatus.

LIQUOR AMMONIÆ ACETATIS.

Ingredients:

Distilled vinegar,
Sesquicarbonate of ammonia.

Decomposition. The acetic acid, by its greater affinity combines with ammonia, displacing the carbonic acid, which escapes with effervescence.

When pure, this liquid affords no precipitate with hydrosulphuric acid, proving the absence of metallic salts: chloride of barium and nitrate of silver producing no precipitate, shew that neither sulphuric nor hydrochloric acid is present.

Medical Properties. Diaphoretic, refrigerant, and somewhat diuretic. It is much used as a cooling application externally.

Dose. ℥ss. to ℥j.

MORPHIA.

Ingredients:

Hydrochlorate of morphia,
Solution of ammonia,
Distilled water.

Decomposition. The hydrochloric acid combines with the ammonia, forming hydrochlorate of ammonia, and the morphia is precipitated.

Morphia is insoluble in cold water, almost insoluble in ether, soluble in 40 parts of cold alcohol, and in 30 parts of boiling alcohol. Potash and soda dissolve it very readily. It is turned red, afterwards yellow, by nitric acid. It forms a blue colour with the tincture of sesquichloride of iron; if chlorine and ammonia by added to its salts, they are rendered brown, which colour disappears if more chlorine be added.

Composition:

34	carbon	34 × 6 =	204
18	hydrogen	18 × 1 =	18
6	oxygen	6 × 8 =	48
1	nitrogen		14
		Atomic number ...	284

Morphia, uncombined with an acid, is not used medicinally, as it would have no action on the system, unless it met with some acid in the stomach to give it solubility. It is introduced in the Pharmacopœia to assist in forming the next preparation.

MORPHIÆ ACETAS.

Ingredients:

Morphia,
Acetic acid,
Distilled water.

Chemical Action. The acetic acid unites with the morphia, forming an acetate, which by evaporation is procured in crystals.

This preparation is very soluble in water, and can therefore be conveniently given in small doses.

Medical Properties. This salt, as well as the following, possesses the most valued properties of opium in a concentrated form, one grain of either being equal in effect to about 4 grains of opium. It does not stimulate quite in the same proportion

as opium, nor does it occasion quite so much disturbance of the stomach, or the violent headach on the following morning.

Dose. Gr. $\frac{1}{4}$ to gr. j.

HYDROCHLORAS MORPHIÆ.

Ingredients:

Opium,
Crystals of chloride of lead,
Animal charcoal,
Hydrochloric acid,
Distilled water,
Solution of ammonia.

By the maceration, expression, and bruising, the soluble principles of the opium are dissolved, and the solution is then evaporated to the consistence of a syrup. This is to be treated with three pints of water, and then allowed to stand, that the dregs may subside, and the supernatant solution is to be preserved for use. This solution contains meconate of morphia: when the chloride of lead is added, water is decomposed, its hydrogen uniting with the chlorine forms hydrochloric acid, which unites itself with the morphia, forming a soluble hydrochlorate of morphia; the oxygen of the water with the lead forms an oxide, which combines with the meconic acid, and is precipitated; the solution is then evaporated, that the hydrochlorate of morphia may be obtained in crystals: they are then to be dissolved in water, and

digested with charcoal, that any colouring matter may be removed; and after straining, the solution is to be again evaporated till crystals are produced.

The solution poured off from the first crystals, containing some hydrochlorate of morphia, is to be treated with ammonia, to precipitate any morphia, which is to be mixed with some hydrochloric acid: this is to be treated with some charcoal, as just mentioned, then strained and evaporated to crystallization.

The first part of the process in which ammonia is not employed is insufficient for obtaining pure hydrochlorate of morphia; it appears that it is combined with another alkaline principle of opium, named codeia; but that when ammonia is added to a solution of hydrochlorate of morphia and codeia, the morphia is alone precipitated, and a triple salt of hydrochlorate of ammonia and codeia remains in solution.—*Vide Mr. Pereira's Lectures on Materia Medica.*

This salt of morphia possesses the same properties as the acetate, and is given in similar doses. It is thought by many to be more certain in its operation, and certainly can be kept for a longer time without any change taking place in it.

Dose. Gr. $\frac{1}{4}$ to gr. j.

QUINÆ DISULPHAS.

Ingredients:

Yellow cinchona bark,
Sulphuric acid,
Animal charcoal,
Hydrated oxide of lead,
Solution of ammonia,
Distilled water.

Chemical Changes. By boiling the bark with the water and sulphuric acid, the active principles of the cinchona are dissolved. When the oxide of lead is added, it attracts the sulphuric acid, and an insoluble sulphate of lead is precipitated, quina with kinic acid remaining in solution; when to the solution, ammonia is added, it unites with the kinic acid, and the separated quina is precipitated. This is then to be separated by filtration, and saturated with dilute sulphuric acid, purified by digesting with charcoal, and evaporated that it may pass into crystals.

Composition :

1	sulphuric acid		= 40
2	quina	2 × 162	= 324
8	water	8 × 9	= 72
		Atomic number ...	436

Qualities. It is entirely soluble in water, especially if a little acid be added. To ascertain an

admixture of sugar, ammonia should be added to precipitate the quina; if, what remains after evaporation has a sweet taste, we may conclude that sugar has been used for adulteration. It contains about 9 per cent. of water, and is entirely volatilized by heat.

Medical Properties. It possesses the virtues of cinchona in a concentrated form, and has justly obtained the character of being a most valuable tonic.

The best mode of administering it, is in distilled water, with two or three drops of dilute sulphuric acid.

Dose. Gr. j. to gr. v.

STRYCHNIA.

Ingredients:

Nux vomica,
Rectified spirit,
Dilute sulphuric acid,
Magnesia,
Solution of ammonia.

The most active principle of nux vomica is strychnia, and this is combined with an acid, which by this process is separated, and the strychnia is procured in a free state. The acid by many is named igasuric, by others strychnic.

Chemical Changes. By the boiling in spirit and the pressure, the soluble active matter of the seed is extracted. This is reduced to the consistence of an extract, and is dissolved in water, and strained, and then evaporated to the consistence of a syrup; to this, whilst hot, magnesia is added to combine with the strychnic acid, and precipitate the strychnia. The precipitate is then to be treated with hot spirit, which dissolves out the strychnia, and yields it again by distillation: to this residue add dilute sulphuric acid, by which a sulphate of strychnia is formed, and may be crystallized by evaporation. These crystals are then to be dissolved in water, and when ammonia is added the acid combines with the ammonia, forming a soluble compound, and the strychnia is precipitated: this is finally to be dissolved in hot spirit, and set aside, that it may gradually crystallize.

Qualities. It is readily soluble in hot alcohol, not so in water. It liquifies by heat, and if the heat be increased, it is entirely dissipated.

Strychnia is a vegetable alkali, combining with acids, and forming with them neutral salts.

Nux vomica contains another alkaline principle in small quantity, named brucia, to which no allusion is made either in the Pharmacopœia or by Mr. Phillips. It would be procured by the steps adopted in the above process, in combination with strychnia, unless the alcohol which is last used be sufficient to retain all the brucia in the solution, whilst the strychnia gradually crystallizes. Brucia is distinguished from strychnia by being reddened by nitric acid, in the same

manner as morphia. It acts, like strychnia, on the body, but is much weaker. Strychnia is very often combined with it, which may account for some persons appearing to bear much larger doses than others.

Composition:

30	carbon	30 × 6 =	180
16	hydrogen	16 × 1 =	16
3	oxygen	3 × 8 =	24
1	nitrogen		14
	Atomic number ...		234

Medical Properties. It is tonic and stimulant, exerting its action most on the spinal cord, and perhaps more on the anterior than on the posterior column. It is used most successfully in paralysis, where the source of the affection is in some part of the medulla spinalis. It has been given by many in chorea, epilepsy, neuralgia, &c.

Dose. Gr. $\frac{1}{16}$ to gr. j.; very carefully increased.

VERATRIA.

Ingredients:

Sabadilla,
Rectified spirit,
Dilute sulphuric acid,
Solution of ammonia,
Purified animal charcoal,
Magnesia.

The active principle of sabadilla is veratria in combination with gallic acid.

Chemical Changes. By the boiling and pressure, the gallate of veratria is dissolved, and the solution is distilled and evaporated to the consistence of an extract. When this is dissolved in water, and treated with the sulphuric acid, sulphate of veratria is formed. This is then decomposed by magnesia, which unites with the sulphuric acid, forming a soluble sulphate, and the veratria is precipitated. The veratria being collected is again treated with sulphuric acid, and charcoal is added to remove any colouring matter. To the strained solution ammonia is to be added, to unite with the sulphuric acid, and the veratria is again precipitated, separated, and dried.

Composition:

34	carbon	$34 \times 6 =$	204
22	hydrogen	$22 \times 1 =$	22
6	oxygen	$6 \times 8 =$	48
1	nitrogen	$=$	14
	Atomic number ...		288

Qualities. Almost insoluble in water; more so in alcohol, and most in æther. It is inodorous, but has a bitter taste.

Medical Properties. Veratria is a powerful errhine, and, taken internally, promotes most of the secretions, especially that from the bowels. In large doses, it purges with much violence, causing bloody evacuations. It has been lately brought into notice by Dr. Turnbull, who lauds in the highest terms the beneficial effects of it in several diseases, especially painful neuralgic affections and partial paralysis. He uses it as an external application, to surfaces deprived of the epidermis. The good effects of it, however, have not been so constant and decided in the hands of other practitioners. It requires to be used with great caution. In animals it causes rapid death, when given in doses of half a grain to two grains, or introduced into the tissues, appearing to act very much like strychnia.

Dose. Gr. $\frac{1}{20}$th.

In ointment, from six to ten grains may be mixed with an ounce of common ointment.

CARBO ANIMALIS PURIFICATUS.

The charcoal is treated with hydrochloric acid, to dissolve the phosphate and carbonate of lime which are mixed with it; and any acid is removed

by repeated washing. Animal Charcoal is used to remove colouring matter in several preparations of the Pharmacopœia.

CORNU USTUM.

Burnt horn consists chiefly of phosphate of lime. The gelatine of horn is dissipated by heat, in the form of ammonia, carbonic acid, oily matter, and water. This substance is considered by Berzelius to be a subsesquiphosphate of lime; that is, a compound of 1 phosphoric acid, with one and a half equivalent of lime.

Burnt horn is seldom used, except in the pulvis antimonialis. It has been supposed by some to be useful in mollities ossium.

TESTA PREPARATA.

This is merely carbonate of lime, with a little animal matter, and may be used in the same cases and doses as prepared chalk.

AQUÆ DISTILLATÆ.

Distilled waters are obtained by introducing into a retort a quantity of vegetable substances,

with water and proof spirit, and distilling over only a part of the liquid.

The object is to procure water, impregnated with the odour and aroma of various vegetables, in a state of combination. The spirit is of use in assisting in the solubility of this aroma, and likewise in protecting these liquids from subsequent decomposition.

Most of the distilled waters are stimulants, and therefore some caution is necessary in prescribing them as vehicles for other substances in the treatment of fevers.

When the fresh herb is employed instead of the dry one, a larger quantity should be used, in consequence of water entering largely into the substance of the fresh plant.

CATAPLASMATA.

The hemlock poultice is an useful application to scrofulous ulcers; it allays pain and irritation, and is also likely to tranquillize the system generally. It is applied usefully to painful swellings of the breast.

CATAPLASMA FERMENTI.

The yeast poultice is considered serviceable in cases of fetid, sloughing, gangrenous sores, and is

frequently prescribed in mortification of the extremities, resulting from local injury. It is thought by some to do good by the carbonic acid, which is evolved.

CATAPLASMA LINI.

Linseed-meal poultice is the most common of these applications. It acts most kindly if it is made with the bruised seeds, from which the oil has not been expressed. The ordinary linseed-meal, prepared from the seeds minutely ground after the removal of the oil, and made into a poultice, is liable to become very hard and dry, and difficult to be removed, and more irritating.

CATAPLASMA SINAPIS.

Mustard poultice, or a sinapism, is used as a rubefacient, counter-irritant, and stimulating application.

It is often prescribed as a substitute for cantharides, in consequence of a more certain and speedy operation. Great care, however, is necessary in the employment of sinapisms. If they are applied to an emaciated, delicate, and weekly body, and left on too long, they may occasion sloughing; in children they act sufficiently in the course of ten or fifteen minutes, and should be carefully watched, so that, as soon as the skin is reddened, they may be removed. They are much

used in apoplexy, applied to the extremities. If put on the dorsum of the foot, calves of the legs, or thighs, from twenty to thirty minutes may be sufficient time to leave them on. When in contact with the soles of the feet, a longer time is necessary to produce any effect, in consequence of the thickness of the epidermis.

Sinapisms are beneficial by drawing blood to the surface, and, consequently, diverting its current from an internal organ. In apoplexy they cause a greater flow of blood to the extremities, relieving the upper part of the body; they may, at the same time, rouse into action the nervous system, depressed by an accumulation of blood in the head; and may in some cases be considered to act as evacuants.

CERATA.

Cerates, so named from wax entering into the composition of many of them, are unctuous applications of a firmer consistence than ointments. Few of them require any particular notice.

CERATUM CANTHARIDES.

This is used to keep up a discharge from blistered surfaces. In some habits it will be liable to cause strangury and bloody urine; the savine cerate is a more safe application.

CONFECTIONES.

CONFECTIO AMYGDALÆ.

The ingredients of this confection are now recommended to be beaten separately, and then mixed, and kept in a dry state. If they are thoroughly incorporated and kept, they are liable to become mouldy. This confection, with water, forms a milky liquid, which is a pleasant demulcent in coughs, and a good vehicle for some more powerful remedies.

CONFECTIO AROMATICA.

The ingredients of this confection are now recommended to be powdered, mixed, and kept dry. If prepared with water, after some time, fermentation takes place, destroying one of the properties of the confection; that is, acting as an antacid. This confection is a warm stimulant, and mildly astringent. It is incompatible with acids.

Dose. ℈j. to ʒss.

CONFECTIO OPII.

This is a stimulating opiate, useful in cases of debility, and the combination of opium with aromatics prevents much of the unpleasant headach so liable to shew itself on the following morning, after the use of opium in general.

Thirty-six grains of this confection contain one grain of opium.

Dose. gr. xv. to gr. xxx.

CONFECTIO PIPERIS NIGRI.

This is an imitation of Ward's Paste. It is employed for internal administration in piles; and is sometimes beneficial in persons of a relaxed and enfeebled habit. It stimulates the intestines, and gives force to the venous circulation.

Dose. ʒss. to ʒjss.

DECOCTA.

Decoctions are made by boiling substances in water, and the quantity of the liquid is to be reduced, so as to concentrate it. By this process, more soluble matter is extracted, but at the same time volatile principles are likely to be dissipated. Vegetables that contain volatile oils as their active ingredient, are not adapted for such preparation.

DECOCTUM ALOES COMPOSITUM.

This is the mildest preparation of aloes. The aloes is modified in its action by the carbonate of potash, which increases its solubility, and appears

to form a soapy compound with it. There are nearly four grains of aloes in each ounce of this decoction.

Medical Properties. It is tonic, stomachic, and often used as an emmenagogue, and by some as a purgative.

In dyspepsia it may be given in doses of three or four drachms twice a day.

As an emmenagogue it is frequently ordered with Mist. Ferri Composita, in the proportion of half an ounce to an ounce of the latter mixture.

As a purgative, from 6 drachms to 1½ ounce may be given.

DECOCTUM CHIMAPHILÆ.

This is a diuretic remedy, of a very doubtful action.

Dose. ℥j. to ℥ij.

DECOCTUM SCOPARII COMPOSITUM.

This is a diuretic preparation, and may be given in doses of two ounces, three times a day.

DECOCTUM VERATRI.

This decoction is intended for external use in some skin diseases, and to destroy insects on the surface of the body.

EMPLASTRA.

EMPLASTRUM BELLADONNÆ.

This is a very useful application to allay pain, in dysmenorrhœa, pleurodynia, pains of the joints; and, in coughs, is found to be of considerable service, applied to the chest.

ENEMATA.

ENEMA ALOES.

This is a very useful injection for removing ascarides from the rectum; it may also be employed in other cases in which purgative enemata are recommended.

ENEMA OPII.

The quantity ordered in the Pharmacopœia is presumed to be proper for an injection to allay irritation in the rectum, or contiguous parts, or to tranquillize the system generally.

Medical men are not agreed upon the relative effects of opium introduced into the stomach and

per anum. Cases have been given by French writers of persons losing their life by small quantities introduced in the latter method; but still I should consider that twice the quantity might be injected into the rectum that should be given by the stomach, providing that each part is in an equally healthy condition, and has not been habituated to the use of opium.

ENEMA TABACI.

The tobacco enema is a powerful sedative and purgative, requiring considerable care in its use. It is chiefly prescribed in cases of hernia; and is recommended by some in enteritis and peritonitis. The strength of it is less than in the former Pharmacopœia.

Eight ounces are a sufficient quantity to be injected at once.

ENEMA TEREBINTHINÆ.

This enema is useful in cases of ascarides; in tænia, the liquid would scarcely pass up sufficiently to come in contact with the worm and remove it. It is a good injection in colic, and may be employed in some cases of enteritis and peritonitis.

EXTRACTA.

Extracts are either expressed juices, evaporated to a proper thickness, or made by decoction in water, and the soluble matter evaporated, or by means of spirits, to extract resinous substances.

Of the expressed juices there are seven, viz.

Extr. Aconiti.
— Belladonnæ.
— Colchici Cormi.
— Conii.
— Digitalis.
— Hyoscyami.
— Lactucæ.

EXTRACTUM ALOES PURIFICATUM.

By the maceration in water, the resinous matter is separated, and we obtain a form of aloes less irritating to the rectum. It is given in rather larger doses than the common extract.

EXTRACTUM COLCHICI CORMI.

This extract is procured by pressing the fresh cormus of colchicum, and evaporating the expressed juice to a proper consistence.

Dose. Gr. j. to gr. iij.

EXTRACTUM COLCHICI ACETICUM.

This extract is given in about the same doses as the former, in gout and rheumatism.

EXTRACTUM COLOCYNTHIDIS COMPOSITUM.

This extract with calomel forms one of our most common purging pills. It is very apt to gripe; but this effect may be corrected by combining with it some extract of henbane or volatile oils.

EXTRACTUM ELATERII.

This substance is prepared differently from all other extracts, and should rather be called a dried fæcula.

If much pressure be used, the drug will be darker-coloured than usual, and less active, in consequence of an increased proportion of mucilaginous matter.

Dose. Gr. $\frac{1}{4}$ to gr. ij., cautiously increased.

Seven of the extracts are made by macerating the vegetable substance in water, then using decoction, straining, and finally evaporating to a proper consistence.

They are Extractum Gentianæ.
——— Glycyrrhizæ.
——— Hæmatoxyli.
——— Lupuli.
——— Sarzæ.
——— Taraxaci.
——— Uvæ Ursi.

EXTRACTUM JALAPÆ.

This extract is procured in a peculiar manner. It is first digested in spirit, to dissolve the resinous matter, and the tincture is poured off into another vessel. The residue is then to be boiled in water, to dissolve the gummy ingredients. The decoction and tincture are to be strained separately, the tincture to be distilled, and the decoction evaporated, and the resulting extracts to be mixed together. The distillation in the one case is employed for the sake of economy, viz. to save the spirit. This extract is rather more powerful in its operation than the powder.

EXTRACTUM OPII PURIFICATUM.

The ostensible object of this preparation is to procure a more active form of opium; the impurities are removed, but certainly the drug becomes less powerful. It produces rather less unpleasant effects on the head than common opium.

EXTRACTUM PAPAVERIS.

This extract is made from the dry capsules, and used as a substitute for opium. It does not equally confine the bowels, stimulate, or cause distressing headach.

It is very liable to vary in its strength, from too long or insufficient boiling, and is, altogether, a doubtful remedy.

Dose. gr. iv. to gr. x. From 8 to 10 grains are usually considered to be equivalent to 1 grain of opium.

EXTRACTUM STRAMONII.

This extract is made from the seeds. It is a powerful anodyne, narcotic remedy, and requires to be administered cautiously.

Dose. Gr. $\frac{1}{4}$ to gr. ij.

INFUSA.

Infusions are made, usually, by pouring upon vegetable substances, boiling water, allowing them to stand to cool; then pouring off the clear supernatant liquid, or straining. There are few requiring any particular notice.

INFUSUM DIGITALIS.

This is now made in the proportion of one drachm of the dried leaves to 21 ounces of fluid; about half an ounce of it may be considered equal in effect to one grain of the powder.

Dose. ʒij. to ʒvj. three times a day.

INFUSUM DIOSMÆ.

This preparation is diuretic, and possibly tonic to the urinary organs.

Dose. ʒj. to ʒij.

INFUSUM KRAMERIÆ.

This infusion is astringent, and slightly tonic.

Dose. ʒj. to ʒij.

INFUSUM LUPULI.

A new formula for the administration of hops. It is tonic, stomachic, anodyne, and soporific.

Dose. ʒj. to ʒij.

INFUSUM PAREIRÆ.

This infusion is given as a tonic to the urinary organs, and to allay irritation, in doses of ʒiss. to ʒij. It is a remedy of very doubtful efficacy.

INFUSUM SCOPARII.

It is given in dropsies, chiefly as a diuretic.

Dose. ʒj. to ʒij.

LINIMENTUM ÆRUGINIS.

This preparation is used as an escharotic and detergent application to unhealthy sores in the throat.

LINIMENTUM HYDRARGYRI COMPOSITUM.

This is a form for applying mercury to the surface, which is in many cases more active than the stronger mercurial ointment. About a drachm of it may be used for each inunction.

MEL BORACIS.

This has long been a favorite remedy in treating the thrush of infants. It is a cooling and detergent application. Half a tea-spoonful may be introduced into the mouth, three or four times a day.

METALLICA.

Metallic Preparations.

ALUMEN EXSICCATUM.

By heat, the water of the alum is expelled. In its dry state, alum becomes mildly escharotic.

Composition of crystallized alum:

3 sulphate of alumina	$3 \times 58 =$	174
1 —— potash		88
25 water	$25 \times 9 =$	225
		487

LIQUOR ALUMINIS COMPOSITUS.

This is simply a solution of alum with sulphate of zinc, without any decomposition.

Medical Properties. It is used in the form

of a collyrium, diluted with six or eight times as much water. It forms a good injection in leucorrhœa and gleet, and is said to be useful in the treatment of chilblains.

ANTIMONII OXYSULPHURETUM.

Ingredients:

Sesquisulphuret of antimony,
Solution of potash,
Distilled water,
Dilute sulphuric acid.

Decomposition. When the first three are boiled together, part of the potash and sesquisulphuret of antimony decompose each other, forming sesquioxide of antimony, and sulphuret of potassium, whilst the rest of the sesquisulphuret is held in solution by the undecomposed potash.

When the acid is added, it unites with the potash, forming a sulphate of potash in solution; and, at the same time, some water is decomposed, the hydrogen of which, with the sulphur of the sulphuret of potassium, forms hydrosulphuric acid gas, and is evolved, and the oxygen of the water unites with the potassium, forming potash, which combines with the sulphuric acid. We have precipitated sesquioxide of antimony, with sesquisulphuret of antimony.

The decomposition above given is a brief attempt at an explanation of the chemical changes which take place in this preparation. It must be

confessed, that is probably erroneous, if the views taken by Berzelius, Dumas, and other celebrated chemists, are deserving of attention: on their authority, it would appear that when sesquisulphuret of antimony, caustic potash, and water are boiled together, we have produced some sulphuret of potassium and protoxide of antimony; that each of these unites with separate portions of the sesquisulphuret to form two new compounds, the hyposulphantimonite of potassium, and an oxisulphuret of antimony; part of the protoxide also unites with some potash, forming a hypoantimonite of potash. When the sulphuric acid is added, we obtain sulphate of potash; hydrosulphuric acid gas is evolved, and oxide of antimony, with sesquisulphuret of antimony, is precipitated. For more minute particulars, the reader is referred to Mr. Pereira's Lectures, in *Medical Gazette* for *May* 21, 1836.

This preparation is variable in its composition; according to an analysis of Mr. Phillips, it contains in 100 parts:

Sesquioxide of antimony	12
Sesquisulphuret of antimony	76.5
Water	11.5

Medical Uses. It is considered to be alterative and diaphoretic, and is recommended in some skin diseases. In larger doses it will sometimes act as an emetic. It is an ingredient in the Pilula Hydrargyri Chloridi Composita.

Dose. Gr. j. to gr. iij.

ANTIMONII POTASSIO-TARTRAS.

Ingredients:

Sesquisulphuret of antimony,
Powdered nitrate of potash,
Bitartrate of potash,
Hydrochloric acid,
Distilled water.

Decomposition. When the sesquisulphuret of antimony and nitrate of potash are ignited together, they are both decomposed; a portion of the oxygen of the nitric acid combines with part of the sulphur, forming sulphuric acid, which unites with the potash, forming sulphate of potash; a portion of the oxygen unites with a portion of the antimony, forming sesquioxide of antimony, which is mixed with some undecomposed sulphuret.

The hydrochloric acid which is added, prevents the formation of sulphuret of potassium, or free potash.

The substance is then washed, to remove sulphate of potash, and chloride of potassium, leaving behind sesquioxide of antimony, with sesquisulphuret of antimony.

When this is treated with bitartrate of potash, a portion of the acid unites with the sesquioxide of antimony, and this, with the tartrate of potash, forms a double salt in solution.

The solution is then filtered to get rid of the sesquisulphuret of antimony, and by evaporation, the salt is obtained in crystals, the form of which is an octohedron, with a rhombic base.

Tartar emetic may be considered a compound of one equivalent of ditartrate of antimony, with one of tartrate of potash, and three of water, or

2 tartaric acid	2 × 66 =	132
1 potash	=	48
2 sesquioxide of antimony	2 × 77 =	154
3 water	3 × 9 =	27
		361

Tests of its Purity. It should be quite soluble in water, without any bitartrate adhering to the vessel; with hydrosulphuric acid, it gives an orange red precipitate. We ascertain the absence of sulphuric acid, by the chloride of barium producing no precipitate, and of hydrochloric acid, by nitrate of silver not giving a white precipitate. Nitric acid can throw down the oxide of antimony, and subsequently dissolve it.

Medical Properties. This salt is the most active of the antimonial preparations. It is alterative, diaphoretic, diuretic, expectorant, purgative, and emetic. It is given generally in fevers, in pulmonary inflammations, hooping-cough, croup, and orchitis; it is one of the best emetics at the commencement of the exanthemata, and fevers generally, but is contra-indicated where there is much debility. It is likewise applied to the skin, mixed with lard, in liniments, or plasters, to produce a pustular eruption.

Dose. As an expectorant, gr. $\frac{1}{8}$.
a diaphoretic, gr. $\frac{1}{4}$.
a purgative, gr. $\frac{1}{2}$.
an emetic, gr. j. to gr. iij.

The wine of the above salt contains two grains in an ounce.

PULVIS ANTIMONII COMPOSITUS.

Ingredients:

Sesquisulphuret of antimony,
Horn shavings.

By exposing these substances to heat, the sulphur of the antimony attracts oxygen from the air, forming sulphurous acid gas, which flies off, the antimony attracting oxygen, forms the peroxide of antimony, or antimonious acid. The gelatine of the horn is decomposed, and converted into ammonia, carbonic acid, oily matter, and water, leaving behind phosphate of lime. Thus the resulting powder is a mixture of phosphate of lime and antimonious acid, or occasionally sesquioxide of antimony.

Antimonious acid has no activity as a medicine, like the sesquioxide. This preparation is very objectionable, on account of the uncertainty of its composition.

Medical Properties. Considered by some to be diaphoretic, sedative, and purgative.

Dose. Gr. ij. to gr. vj.

Antimony combines with oxygen in three proportions.

The protoxide, or more correctly, the sesquioxide of antimony, contains	$1\frac{1}{2}$	oxygen,
	1	antimony.
Antimonious acid, sometimes called peroxide of antimony	2	oxygen,
	1	antimony.
Antimonic acid	$2\frac{1}{2}$	oxygen,
	1	antimony.

ARGENTI CYANIDUM.

Ingredients:

Nitrate of silver,
Dilute hydrocyanic acid,
Distilled water.

Decomposition. The hydrocyanic acid and oxide of silver are mutually decomposed, the oxygen, with the hydrogen, forming water, the cyanogen, with the silver, forming an insoluble cyanide of silver, which is precipitated; the nitric acid being set free in the solution.

Cyanide of silver is a beautifully white substance, insoluble in cold nitric acid, but soluble in it when hot and concentrated. It is decomposed by hydrochloric acid, hydrosulphuric acid, and hydrosulphates, and is soluble in ammonia. By heat cyanogen gas is expelled, and metallic silver is left.

This substance is only introduced, to be used for rapidly procuring hydrocyanic acid

Composition:

1 cyanogen	=	26
1 silver	=	108
		134

ARGENTI NITRAS.

Ingredients:

Silver,
Nitric acid,
Distilled water.

Decomposition. A portion of nitric acid is decomposed, and converted into oxygen and binoxide of nitrogen; the oxygen combines with the silver, to form oxide of silver, with which the undecomposed acid unites, to form nitrate of silver; the binoxide of nitrogen escapes, and, with oxygen of the air, forms nitrous acid fumes. The solution is then heated, to drive off the water and any excess of nitric acid.

Qualities. It is white, but turns dark by exposure to light. It is quite soluble in water. The solution yields a precipitate of silver, if copper be put into it.

Composition:

1 nitric acid	= 54
1 oxide of silver	= 116
	170

It is an anhydrous salt.

Medical Properties. Tonic, antispasmodic, astringent, and powerfully caustic. It is most frequently given internally, in epilepsy.

Dose. Gr. $\frac{1}{4}$ to gr. ij., gradually increased.

LIQUOR POTASSÆ ARSENITIS.

Ingredients:

Arsenious acid,
Carbonate of potash,
Compound tincture of lavender,
Distilled water.

Decomposition. The arsenious acid combines with the potash, forming arsenite of potash in solution, the carbonic acid being expelled.

Two drachms of this solution contain one grain of arsenious acid. It is known by the name of "Fowler's Solution."

Medical Properties. Tonic and alterative, given in agues, neuralgic affections, periodical headachs, and some skin diseases.

Dose. ♏ vi. gradually increased to ♏ xv.

BARII CHLORIDUM.

Ingredients:

Carbonate of baryta,
Hydrochloric acid,
Distilled water.

Decomposition. The oxygen of the baryta combines with the hydrogen of the acid, forming water; the chlorine, with the barium, forms the

chloride of barium, which is held in solution, and carbonic acid is evolved. By evaporation, the chloride is procured in crystals.

Composition of the crystals:

1 chlorine		= 36
1 barium		= 68
2 water	2 × 9	= 18
	Atomic number	122

This substance is scarcely to be considered a medicine; formerly it was prescribed in scrofula, but appeared to have no very beneficial action. It is chiefly employed by chemists, to detect the presence of sulphuric acid, or sulphates.

BISMUTHI TRISNITRAS.

Ingredients:

Bismuth,
Nitric acid,
Distilled water.

Decomposition. When the nitric acid and part of the water are mixed, and the bismuth is added to them, a portion of the nitric acid is decomposed, giving oxygen to the bismuth, whilst binoxide of nitrogen is evolved; the undecomposed acid combines with the oxide, forming a nitrate of bismuth.

When the remaining water is added, the nitrate is decomposed, and resolved into an insoluble trisnitrate of bismuth, which is precipitated, and a supernitrate which is held in solution.

Composition:

1 nitric acid		= 54
3 oxide of bismuth	3 × 80	= 240
		294

Qualities. It is soluble in nitric acid, without effervescence; thus shewing that no carbonate is present. If in this solution sulphuric acid causes no precipitate, it proves the absence of lead.

Medical Properties. Tonic, antispasmodic, and sedative; useful in pyrosis, gastrodynia, and dyspepsia.

Dose. Gr. v. to gr. xv.

CALX.

Lime is procured conveniently from chalk, by burning it to expel the carbonic acid; by burning 100 parts of chalk, nearly 56 parts of lime remain, in accordance with the combining proportions exhibited by the atomic theory.

The lime is mentioned, on account of being employed in the preparation of liquor calcis, liquor ammoniæ, liquor potassæ, potassa cum calce, and calcii chloridum.

LIQUOR CALCIS.

This is merely a solution of lime in water. More lime is used than the water can dissolve, and the residual lime is to be put into the bottles, in

order that the water may always be saturated. For, in using this liquid, each time the stopper is taken out, some carbonic acid might enter, and combine with some lime, to form an insoluble carbonate, thus diminishing the quantity of lime in the water.

Lime is more soluble in cold than hot water: thus, a pint of water, at three different temperatures, dissolves the following number of grains:

At 32°	13.25
60°	11.6
212°	6.7

Medical Uses. Antacid, and somewhat astringent. It has been given in dyspepsia, diarrhœa, dysentery, worm cases, and is used externally with linseed oil, in the treatment of burns.

Dose. ℥j. to ℥iij.

CALCII CHLORIDUM.

Ingredients:

Chalk,
Hydrochloric acid,
Water.

Decomposition. The lime of the chalk and the hydrochloric acid decompose each other: the chlorine and calcium form chloride of calcium, the hydrogen and oxygen form water; the carbonic acid is evolved, and the chloride of calcium, by evaporation, is procured in crystals.

This salt rapidly attracts moisture, and is often used by chemists to absorb water, in drying gases. It is soluble in one fourth its weight of water. This solution should afford no precipitate with ammonia, chloride of barium, or a very dilute solution of ferro-cyanide of potassium, shewing the absence of alumina, sulphuric acid, and iron.

Composition:

1 chlorine	= 36
1 calcium	= 20
	56

Medical Uses. Fancied by some to be tonic and deobstruent, in scrofulous affections.

Dose. Gr. x. to ʒss.

CALX CHLORINATA.

Ingredients:

Lime,
Chlorine.

The general opinion is that chlorine gradually combines with the lime, and forms the chloride of lime, probably composed of

2 hydrate of lime	2 × 3 = 74
1 chlorine	= 36
	110

If this substance be put into water, a large quantity of lime is deposited, and the resulting

soluble compound is supposed to be a bihydrated chloride of lime.

Berzelius and Dumas are of opinion, that when the chlorine and lime are brought into contact, a decomposition of part of the lime takes place; chlorine, uniting with the calcium, to form chloride of calcium, and the oxygen of the lime, with chlorine, forming chlorous acid, which combines with the undecomposed lime, forming chloride of lime.

The solution of this substance is called Labarraque's disinfecting fluid.

The chlorine used, is easily procured by the action of two equivalents of hydrochloric acid on one of peroxide of manganese. The decomposition which takes place is the following: the two equivalents of oxygen of the manganese attract the two equivalents of hydrogen of the acid, to form two of water; one equivalent of chlorine combines with the manganese, forming one equivalent of chloride of manganese, whilst one equivalent of chlorine is set free.

Medical Properties. It is used chiefly as a disinfecting agent, sprinkled about rooms. When it is exposed to the air, carbonic acid gradually combines with the lime, and the chlorine is evolved. This liquid decomposes fœtid and offensive gases, by the affinity of chlorine for hydrogen, and possibly may act on animal or vegetable effluvia in such a way as to render them innocuous.

CUPRI AMMONIO-SULPHAS.

Ingredients:

Sulphate of copper,
Sesquicarbonate of ammonia.

Decomposition. The sulphuric acid combines with some ammonia, forming sulphate of ammonia; some carbonic acid, with the oxide of copper, forms a carbonate of copper, and some carbonic acid escapes. The residue is a mixture of carbonate of copper, sulphate of ammonia, with some sesquicarbonate of ammonia.

This salt has, generally, an ammoniacal odour.

Qualities. By heat the ammonia is evolved, and oxide of copper remains. It exhibits an alkaline reaction, and produces a green colour with arsenious acid.

Medical Properties. Tonic, given in epilepsy and chorea; and is sometimes used externally as an application to the eyes.

Dose. Gr. ss. to gr. iij.

FERRI SULPHAS.

Ingredients:

Iron filings,
Sulphuric acid,
Water.

Decomposition. Some water is decomposed, its oxygen with the iron forms oxide of iron, which is immediately attracted by the sulphuric acid, and hydrogen gas is evolved. By evaporation the sulphate of iron is procured in crystals.

Composition:

1 sulphuric acid		= 40
1 protoxide of iron		= 36
7 water	7 × 9	= 63
		139

Qualities. When pure it has a blue tinge; after a little time it becomes more green, and, if exposed to the air, will turn of a light brown colour, in consequence of being converted into peroxide of iron. If any sulphate of copper be present, a piece of iron introduced into a solution of it would precipitate copper.

The salts of the protoxide of iron are most active, as medicines.

Medical Uses. Tonic, emmenagogue, somewhat astringent, and, in large doses, emetic; it is one of the best preparations of iron.

Dose. Gr. j. to gr. v.

FERRI AMMONIO-CHLORIDUM.

Ingredients:

Sesquioxide of iron,
Hydrochloric acid,
Hydrochlorate of ammonia,
Distilled water.

Decomposition. The sesquioxide of iron and hydrochloric acid decompose each other; the chlorine combines with the iron, forming a sesquichloride of iron, the oxygen and hydrogen combining, to form water; to this the hydrochlorate of ammonia is added. After evaporation, the residue consists of about 15 per cent. of sesquichloride of iron, the rest being hydrochlorate of ammonia, in a state of admixture, rather than chemical combination.

Qualities. It is quite soluble in proof spirit and in water. This solution affords a precipitate of sesquioxide of iron, if potash is added to it; and if added in excess, ammonia is evolved.

Medical Properties. Tonic and emmenagogue, but less frequently prescribed than most of the other preparations of iron.

Dose. Gr. ij. to gr. x.

TINCTURA FERRI SESQUICHLORIDI.

Ingredients:

Sesquioxide of iron,
Hydrochloric acid,
Rectified spirit.

Decomposition. The chlorine of the acid combines with the iron, forming the sesquichloride, and the hydrogen, with the oxygen, forms water. The sesquichloride is held in solution by the spirit.

Composition:

1½	chlorine	= 54
1	iron	= 28
		82

One ounce of this solution will yield about 30 grains of sesquioxide of iron.

Medical Uses. Tonic, astringent, and externally styptic. It is an excellent remedy in leucorrhœa and gleet, and menorrhagia, occurring in delicate habits; for children suffering from prolapsus ani; as a tonic in worm cases; and surgeons have found it serviceable in spasmodic stricture of the urethra.

Dose. ♏ x. to ʒss.

FERRI IODIDUM.

Ingredients:

Iodine,
Iron filings,
Distilled water.

This is a case of simple combination between the iodine and the iron, forming the iodide or ioduret of iron, which is procured in the solid form, by expelling the water. It is to be kept away from the air and light, that it may not be decomposed. The iron is apt to be converted into sesquioxide, to prevent which it is recommended to keep a piece of iron wire in it.

Composition :

1 iodine		= 126
1 iron		= 28
5 water	5 × 9	= 45
	Atomic number ...	199

Qualities. By heat it emits vapour of iodine. When pure, it is quite soluble in water. If not, sesquioxide of iron will be precipitated. This is also formed when the iodide has been dissolved some time.

Medical Properties. This remedy combines some of the properties of iodine with those of iron. It is an admirable remedy in some forms of scrofula, in ulcerations of the throat, with atony of system, in general debility, in hysteria and amenorrhœa. From its stimulating qualities, it is contraindicated in plethora or inflammation.

Dose. Gr. ss. to gr. ij.

FERRI POTASSIO TARTRAS.

Ingredients :

Sesquioxide of iron,
Hydrochloric acid,
Solution of potash,
Bitartrate of potash,
Solution of sesquicarbonate of ammonia,
Distilled water.

Decomposition. When the first two ingredients are mixed together, the same change takes place as in the tinctura ferri sesquichloridi. In the second stage, potash and the chloride are both decomposed, the chlorine combining with potassium forms chloride of potassium, the oxygen of the potash, with the iron, forms sesquioxide of iron, which is to be washed to obtain it pure.

When the bitartrate of potash is added, a portion of the acid combines with the oxide of iron, forming a solution of tartrate of potash, with sesquitartrate of iron. If the liquid has an acid reaction, the ammonia is to be added to saturate the excess of acid. By evaporation, the substance is procured in a solid form.

Composition, according to Mr. Phillips:

1 tartrate of potash	= 114
I tartrate of sesquioxide of iron	= 106
	220

Qualities. It is entirely soluble in water, does not change the colour of litmus or turmeric; is not, like other salts of sesquioxide of iron, rendered blue by ferrocyanide of potassium; neither acids nor alkalies produce any precipitate; with other salts of the peroxide, alkalies cause the oxide to be precipitated.

Medical Properties. It is tonic and emmenagogue, and has less taste than most other preparations of iron.

Dose. Gr. v. to gr. xv.

FERRI SESQUIOXYDUM.

Ingredients:

Sulphate of iron,
Carbonate of soda,
Boiling water.

Decomposition. The sulphuric acid combines with the soda, forming sulphate of soda in solution, the carbonic acid unites with the oxide of iron, forming carbonate of iron. By exposure to the air, the iron attracts more oxygen, becoming sesquioxide, and most of the carbonic acid is expelled.

Qualities. It is soluble in hydrochloric acid, with a little effervescence, shewing the presence of some carbonic acid, and should be entirely precipitated from this solution by ammonia.

Medical Properties. Tonic and emmenagogue, given in chlorosis, amenorrhœa, chorea, tic-douloureux, and is a very good medicine for children in worm cases.

Dose. ℈j. to ʒij.

HYDRARGYRUM CUM CRETA.

Ingredients:

Mercury,
Chalk.

By rubbing them together, the mercury is

minutely divided, and mechanically mixed with the chalk. By long trituration, a portion of the mercury may become oxidized.

Qualities. By heat the mercury is driven off in vapour, and a white substance (the chalk) remains, and is soluble in acetic acid, with effervescence. This solution should not be coloured by hydrosulphuric acid: if it is, it shews that the mercury was not pure, and that the adulterating metal remained with the chalk.

Medical Properties. Mild alterative, most fitted for diseases of children.

Dose. Gr. v. to gr. xx.

HYDRARGYRI OXYDUM.

Ingredients:

Chloride of mercury,
Lime-water.

Decomposition. The chloride of mercury and lime decompose each other, producing a chloride of calcium in solution, and a protoxide of mercury precipitated, which is to be washed to remove any lime.

Qualities. If digested with hydrochloric acid for a little time, chloride of mercury will be formed, and, being insoluble, will remain at the bottom of the vessel, and the liquid will afford no precipitate with solution of potash, or oxalate of

ammonia. If there be any orange-red precipitate with the potash, it shews the presence of binoxide of mercury, if a white precipitate is thrown down with the oxalate, lime will be present. It is entirely soluble in acetic acid, and by heat is vaporizable; if not, there is some impurity.

The protoxide of mercury is black. By keeping and exposure to light, it is liable to be partially decomposed, changing to a lighter grey colour, and will be found to consist of a mixture of protoxide of mercury, peroxide of mercury, and metallic mercury.

Composition:

1	oxygen	= 8
1	mercury	= 202
		210

Medical Properties. Alterative, seldom given internally: it was formerly much used for mercurial fumigations.

Dose. Gr. i. to gr. iij.

HYDRARGYRI BINOXYDUM.

Ingredients:

Bichloride of mercury,
Solution of potash,
Distilled water.

Decomposition. One equivalent of bichloride

decomposes two equivalents of potash, the two of chlorine with two of potassium form two equivalents of chloride of potassium, and the two of oxygen, with the one of mercury, form binoxide of mercury, which is precipitated.

Composition:

2 oxygen	$2 \times 8 =$	16
1 mercury	$=$	202
		218

Qualities. When heat is applied it loses oxygen and either passes into vapour, or metallic mercury, it is entirely soluble in hydrochloric acid.

Medical Properties. This is a powerful preparation producing the usual effects of mercury, but is not very manageable. It requires to be given with great caution.

Dose. Gr. $\frac{1}{4}$ to gr. j.

HYDRARGYRI NITRICO-OXYDUM.

Ingredients:

Mercury,
Nitric acid,
Distilled water.

Decomposition. A portion of the nitric acid is decomposed, giving oxygen to the mercury to form binoxide of mercury, binoxide of nitrogen flying off, and with oxygen of the air forming

nitrous acid fumes; the undecomposed acid then unites with the binoxide of mercury, forming pernitrate of mercury, which, by evaporation, is obtained as a white salt.

When this pernitrate is heated, most of the nitric acid is expelled, leaving binoxide of mercury with a small quantity of nitrate.

Qualities. If properly prepared, it emits no nitrous fumes. The water in which it may be boiled or washed should afford no precipitate with lime-water, or hydrosulphuric acid, shewing the absence of nitrate of mercury, or other metallic salts.

Medical Properties. It is not given internally, being too irritating: it is employed externally as an escharotic, and in ointments as a stimulating application.

HYDRARGYRI AMMONIO-CHLORIDUM.

Ingredients:

Bichloride of mercury,
Solution of ammonia,
Distilled water.

Decomposition. The changes which take place here are not thoroughly agreed upon by chemists. Mr. Hennel is of opinion that white precipitate is a compound of one equivalent of binoxide of mercury, with one of hydrochlorate of ammonia. Mr. Phillips is of opinion that it is a compound

of 1 peroxide of mercury, 1 bichloride of mercury, and 2 of ammonia, and is formed in the following manner:—when the bichloride of mercury, ammonia, and water are mixed together, one equivalent of bichloride decomposes two equivalents of water; the chlorine forming with the hydrogen, two equivalents of hydrochloric acid, and these, with two of ammonia, form two equivalents of soluble hydrochlorate of ammonia; the two equivalents of oxygen of the water, with one of mercury, forming binoxide of mercury, which immediately unites with one equivalent of undecomposed bichloride, and two of ammonia, forming an insoluble white precipitate.

Qualities. By heat, it entirely passes into vapour. Digested with acetic acid, no yellow or blue precipitate is formed by adding iodide of potassium. It is not turned black by lime-water. It is entirely soluble in hydrochloric acid, without effervescence. Heated with solution of potash, ammonia is evolved, and it assumes a yellow colour.

The heat proves the absence of fixed impurities: the iodide shews the absence of lead or starch. The lime-water proves the absence of protoxide of mercury: the non-effervescence proves that carbonates are not present; and the last is diagnostic of the preparation, as from no other is ammonia evolved at the same time that binoxide of mercury is thrown down.

Medical Uses. Chiefly as an external application to destroy vermin about the body, and as an ointment in some skin diseases.

HYDRARGYRI CHLORIDUM.

Ingredients:

Mercury,
Sulphuric acid,
Chloride of sodium,
Distilled water.

Decomposition. When the acid and half the mercury are boiling together, two equivalents of the acid are decomposed and resolved into sulphurous acid and oxygen; the sulphurous acid flies off in the form of gas, and the two of oxygen with one of mercury form binoxide of mercury, with which two equivalents of undecomposed sulphuric acid combine, to form bipersulphate of mercury.

When the rest of the mercury is added, it takes away from the bisulphate one equivalent of oxygen, and one of acid, thus forming protosulphate of mercury. When the protosulphate is triturated with chloride of sodium, the oxygen quits the mercury to unite with sodium and form soda; this, with the sulphuric acid, forms sulphate of soda; the chlorine unites with the mercury, forming the chloride or calomel, which is separated by sublimation.

Qualities. It forms a whitish powder, and is turned black by lime-water or potash, in consequence of the formation of protoxide of mercury, and this, by heat, will afford globules of mercury. It entirely passes into vapour by heat. As it is insoluble, water, which is used to wash it, should

afford no precipitate with nitrate of silver, lime-water, or hydrosulphuric acid; otherwise, some bichloride of mercury or other metallic substance is present.

Composition:

1 chlorine	= 36
1 mercury	= 202
	238

Medical Properties. This is the most valuable preparation of mercury; acting mildly, certainly, and powerfully, according to the dose. It is alterative, stimulant (to the secretions generally), purgative, and antisyphilitic; and is a valuable remedy in inflammations of serous membranes.

Dose. As an alterative, gr. $\frac{1}{4}$ to gr. j.
As a purgative, gr. iij. to gr. x.

HYDRARGYRI BICHLORIDUM.

Ingredients:

Mercury,
Sulphuric acid,
Chloride of sodium,
Water.

Decomposition. The same chemical action takes place here, as in the first stage of the preparation of the chloride, that is, a bipersulphate of mercury is formed. When this is dried and mixed with chloride of sodium, and heat is applied,

the oxygen of the binoxide of mercury combines with the two of sodium, forming two of soda, these with the two sulphuric acid form two of sulphate of soda; the two of chlorine, with one of mercury, form one equivalent of bichloride of mercury, which is separated from the sulphate of soda by sublimation.

Composition:

2 chlorine	2 × 36 =	72
1 mercury	=	202
		274

Qualities. It liquefies by heat, and then passes into vapour. It is entirely soluble in water and ether. Potash or lime-water decompose it, and throw down a red binoxide of mercury, which by being heated, parts with oxygen, and affords globules of mercury.

Medical Properties. Generally given as an alterative in secondary syphilis, in skin diseases, and in scrofula; and is used externally in collyria, or washes for other parts.

Dose. $\frac{1}{16}$ of a grain, gradually increased to $\frac{1}{4}$.

HYDRARGYRI BICYANIDUM.

Ingredients:

Percyanide of iron (Prussian blue),
Binoxide of mercury,
Distilled water.

Decomposition. The percyanide and binoxide decompose each other; the cyanogen unites with the mercury to form a soluble bicyanide of mercury; the oxygen with the iron forms a sesquioxide which is precipitated. By evaporation the bicyanide is procured in crystals. It may also be obtained by adding the binoxide of mercury to hyrocyanic acid, when we have formed two equivalents of water, and one of bicyanide of mercury.

Composition:

2 cyanogen	2 × 26 =	52
1 mercury	2 =	202
		254

Qualities. It is translucent, and totally soluble in water. When hydrochloric acid is added to it, bichloride of mercury and hydrocyanic acid are formed; the latter of which is known by its odour, and throws down a precipitate from nitrate of silver, soluble in hot nitric acid. By heat cyanogen is evolved, leaving globules of mercury.

This is not given medicinally, and is only intended to be employed in procuring hydrocyanic acid.

HYDRARGYRI IODIDUM.

Ingredients:

Mercury,
Iodine,
Alcohol.

The mercury and iodine combine directly, and by heat a substance is obtained of an olive green colour. This is liable to be decomposed by light, which converts it into iodine and biniodide.

Composition:

1	iodine	= 126
1	mercury	= 202
		328

Qualities. By heat, cautiously applied, it can be sublimed into red scales, which, on cooling, turn yellow, and on the admission of light, black. It is not soluble in chloride of sodium, like the biniodide.

Medical Properties. It is used very successfully in syphilis, and especially when that disease attacks a person of a scrofulous habit of body.

Dose. Gr. j. to gr. iij.

HYDRARGYRI BISULPHURETUM.

Ingredients:

Mercury,
Sulphur.

By heating these together, chemical union takes place; bisulphuret of mercury is formed, and a portion of the sulphur is expelled.

Composition:

2 sulphur	2 × 16 =	32
1 mercury	=	202
		234

Qualities. By heat it passes into vapour, and, if potash be added, it affords globules of mercury, in consequence of the action of the sulphur upon the potash. Neither nitric nor hydrochloric acid acts upon it; but when they are mixed and added, the mercury is dissolved. It is insoluble in rectified spirit, and consequently that liquid, after contact with it, acquires no colour. If it is digested with acetic acid, and the liquid affords no yellow precipitate with iodide of potassium, it proves that lead has not been used to adulterate it.

Medical Properties. A mild alterative in skin diseases. Generally employed for fumigations, a practice not very common at the present day.

Dose. Gr. x. to gr. xxx.

HYDRARGYRI BINIODIDUM.

Ingredients:

Mercury,
Iodine,
Alcohol.

This is a case of direct combination of iodine with mercury, forming the biniodide.

Composition:

2 iodine	2 × 126	= 252
1 mercury		= 202
		544

Qualities. By heat carefully applied, it passes into scales, which turn yellow, and on cooling again becomes red. It is partially soluble in hot rectified spirit, and on cooling, the biniodide forms in crystals. It is soluble either in excess of iodide of potassium or bichloride of mercury, and is entirely soluble in chloride of sodium, which will distinguish it from the iodide of mercury.

Medical Properties. The same as of the iodide, but more powerful in its action.

Dose. Gr. $\frac{1}{2}$ to gr. ij.

HYDRARGYRI SULPHURETUM CUM SULPHURE.

Ingredients:

Mercury,
Sulphur.

When these are rubbed together, the mercury combines with part of the sulphur, the rest being mechanically mixed with it.

It is presumed to contain in 100 parts

Bisulphuret of mercury	52
Sulphur	42

Qualities. By heat it entirely passes into vapour, without leaving charcoal or phosphate of lime, shewing that animal charcoal has not been mixed with it for adulteration.

Medical Properties. A very mild alterative, only given to children.

Dose. Gr. v. to gr. xx.

MAGNESIA.

This is prepared from the carbonate by the application of heat, by which the carbonic acid is evolved.

Composition:

1 oxygen	= 8
1 magnesium	= 12
	20

Qualities. It is soluble in hydrochloric acid, without effervescence, and might be distinguished from the other alkaline earths by its solubility in sulphuric acid. The solution, with hydrochloric acid, produces no precipitate with bicarbonate of potash, or chloride of barium, shewing the absence of lime, and any sulphate. It has a feeble alkaline action on turmeric paper.

Medical Properties. Antacid, and aperient if there be much acid in the intestinal canal. It is preferable to the carbonate, when we wish to avoid flatulence.

Dose. ℈j. to ʒj.

It is much used in pharmacy to assist in extracting the alkaline bases of vegetables.

MAGNESIÆ CARBONAS.

Ingredients:

Sulphate of magnesia,
Carbonate of soda,
Distilled water.

Decomposition. There is an exchange of acids between the magnesia and soda, the products being sulphate of soda in solution, and carbonate of magnesia precipitated, which is to be thoroughly washed and dried.

Composition:

1 carbonic acid	= 22
1 magnesia	= 20
	42

Qualities. The water in which it may be boiled does not alter the colour of turmeric; there is no precipitate with chloride of barium or nitrate of silver in this liquid, proving the absence of sulphuric or hydrochloric acid. It is soluble in dilute sulphuric acid, 36.6 per cent. of its weight being lost, by the escape of carbonic acid. When the effervescence has ceased, there is no precipitate produced by the bicarbonate of potash; any precipitate would indicate impurity.

Medical Properties. The same as of preceding preparation, and given in about the same doses.

PLUMBI ACETAS.

Ingredients:

Oxide of lead,
Acetic acid,
Distilled water.

Chemical Changes. The acetic acid combines with the oxide of lead, and dissolves it; and, by evaporation, the salt is procured in crystals.

Composition:

1 acetic acid		= 51
1 oxide of lead		= 112
3 water	3 × 9	= 27
		190

Qualities. Quite soluble in water. Its solution affords a white precipitate with carbonate of soda, viz. the carbonate of lead; with iodide of potassium, a yellow precipitate of iodide of lead falls. By hydro-sulphuric acid, a sulphuret of lead is thrown down; with sulphuric acid, a white insoluble sulphate of lead is formed; and the odour of acetic acid is made perceptible. By heat it first melts, and ultimately is converted into metallic lead.

Medical Properties. Sedative, astringent, and tonic; often prescribed in hæmorrhages, and

has been given in diarrhœas and dysentery. It is also employed as an injection, and as a cooling collyrium and lotion.

Dose. Gr. j. to gr. iij.

LIQUOR PLUMBI DIACETATIS.

Ingredients:

Acetate of lead,
Oxide of lead,
Water.

When the above ingredients are boiled together, the acetate of lead parts with portion of its oxygen forming a dinacetate, that is a compound of two equivalents of oxide of lead with one of acetic acid. Its atomic number is 275.

This liquid has long been known under the name of "Goulard's Extract."

Sp. gr. of the liquid 1.260.

Medical Uses. It is employed externally as a cooling application in inflammations, in the form of a lotion.

PLUMBI CHLORIDUM.

Ingredients:

Acetate of lead,
Distilled water,
Chloride of sodium.

Decomposition. The chlorine of the salt combines with the lead, and is precipitated; the oxygen of the lead combines with the sodium, forming soda, and this with the acetic acid forms an acetate of soda in solution.

Composition:

1 chlorine	= 36
1 lead	= 104
	140

Qualities. It is entirely soluble in boiling distilled water, shewing the absence of the sulphate of lead, and again falls and crystallizes on cooling. It is blackened by hydrosulphuric acid, which forms a sulphuret of lead, and turns yellow by heat.

This substance is only used pharmaceutically in the preparation of morphia.

PLUMBI IODIDUM.

Ingredients:

Acetate of lead,
Iodide of potassium,
Distilled water.

Decomposition. The chemical action in this preparation is very similar to the former. The iodine combines with the lead, forming iodide of lead, which is precipitated; the oxygen with the potassium forming potash, which is held in solution by the acetic acid.

Composition:

1 iodine	= 126
1 lead	= 104
	230

Qualities. It is entirely soluble in boiling water, from which it falls, on cooling, in the form of shining yellow scales. It liquefies by heat, first giving off yellow vapours, and afterwards violet coloured. The greater part of it is driven off.

Medical Uses. Iodide of lead acts upon the body like most other preparations of iodine, and in some cases is very powerful. It is employed both internally and externally, for the purpose of reducing glandular tumours.

Dose. Gr. $\frac{1}{4}$ to gr. j.

PLUMBI OXYDUM HYDRATUM.

Ingredients:

Solution of diacetate of lead,
Distilled water,
Solution of potash.

Decomposition. The acetic acid combines with the potash, causing the oxide of lead to be precipitated, in combination with a little water.

Qualities. It should be entirely soluble in nitric acid, otherwise we might infer the presence of some sulphate.

Uses. It is employed in the preparation of the disulphate of quinine, and is not given by itself as a medicine.

LIQUOR POTASSÆ.

Ingredients:

Carbonate of potash,
Lime,
Distilled water.

Decomposition. The carbonic acid combines with the lime forming carbonate of lime, which is insoluble, and remains at the bottom, and the potash set free, is held in solution.

This is simply a solution of pure potash in water. It is apt to act upon common flint glass.

Qualities and Tests. Sp. gr. 1.063. It has a powerful alkaline reaction, turning tumeric paper brown. No effervescence should arise by adding acids to it, thus shewing the absence of carbonic acid; there should be no precipitate from carbonate of soda, chloride of barium, or nitrate of silver, proving the absence of earthy impurities, any sulphate, or hydrochlorate; the chloride of platinum occasions a precipitate of a yellow colour with this solution, as well as with the salts of potash, but has no visible effect on soda, and its salts; and, therefore, will readily distinguish potash from soda.

Medical Properties. Antacid, tonic, diuretic, lithontriptic, and externally caustic. It is of ser-

vice in dyspepsia, skin diseases, in morbid accumulations of uric acid, and in scrofulous affections.

Dose. ♏ x. to ʒss. If given in common beer, it may be administered in much larger doses.

POTASSA CUM CALCE.

Ingredients:

Solution of potash,
Lime.

By heat, most of the water is expelled; and the residue is a mechanical mixture of potash and lime.

It is partially soluble in alcohol, the potash only being taken up.

It is used as a caustic, and as a substitute for the hydrate of potash, being less deliquescent and more manageable.

POTASSÆ ACETAS.

Ingredients:

Carbonate of potash,
Acetic acid,
Distilled water.

Decomposition. The acetic acid combines with the potash, forming the acetate, carbonic acid flying off; the solution is then evaporated till the salt becomes properly dried.

Composition:

1 acetic acid	=	51
1 potash	=	48
		99

Qualities and Tests. It is entirely soluble in water and alcohol. This solution has no effect upon test papers, shewing its neutrality. The chloride of barium and nitrate of silver causing no precipitate, prove the absence of sulphates or hydrochlorates. If the solution be concentrated, some acetate of silver may fall, which will be soluble in nitric acid; not so, any chloride. By a red heat, it is decomposed, and converted into carbonate of potash. Sulphuric acid added to it, occasions an odour of acetic acid, which is set free.

Medical Properties. Diuretic and purgative; seldom prescribed for the latter object.

Dose. As a diuretic ʒss. to ʒij.
As a purgative ℥ss. to ʒvj.

POTASSÆ CARBONAS.

This substance is obtained from the impure carbonate of potash, commonly named pearlash, by dissolving it in water, then straining to separate earthy matter and other insoluble impurities. By evaporation, the excess of water is expelled, and the salt is obtained in a solid granulated state.

Composition:

1	carbonic acid	= 22
1	potash	= 48
$1\frac{1}{2}$	water	= 13.5
		83.5

Qualities and Tests. It is almost entirely soluble in water; that which is not, is some earthy matter: it absorbs water readily if exposed to the air, and spontaneously liquefies. It changes the colour of tumeric paper to brown. When supersaturated with nitric acid, if there were earthy matter present, it would afford a precipitate with carbonate of soda; chloride of barium would detect any sulphate, and nitrate of silver any hydrochlorate. By heat, 100 parts lose 16 of their weight of water; by adding sulphuric acid, the weight of carbonic acid evolved is equal to 28 parts per cent.

Medical Properties. Antacid, tonic, and diuretic; generally given with some acid as a neutral salt.

Dose. Gr. x. to ʒss.

POTASSÆ BICARBONAS.

This salt is made by transmitting carbonic acid through a solution of the carbonate of potash to saturation. This is conveniently effected by Woulfe's apparatus: we conclude that the liquid is saturated by the carbonic acid escaping from

the last jar. The solution is then to be evaporated with a gentle heat, as a higher temperature would expel the carbonic acid, which has been added.

The carbonic acid is very readily procured by the action of dilute sulphuric acid on powdered chalk.

Composition:

2 carbonic acid	2 × 22	= 44
1 potash		= 48
1 water		= 9
		101

Qualities. It is entirely soluble in water, and very slightly affects the colour of turmeric paper. Sulphate of magnesia causes no precipitate in its solution. By heat, 30.7 parts per cent. of its weight are expelled; chloride of barium should occasion no precipitate in it, and there should be scarcely any by nitrate of silver. If any notable precipitate falls, there is probably a minute portion of chloride of potassium present.

Medical Uses. It is given for the same purposes, and in the same doses, as the former; and is often preferred on account of its more agreeable flavour. Its saturating powder is less, in consequence of containing more acid, and of course a less proportion of base.

LIQUOR POTASSÆ EFFERVESCENS.

This is a solution of bicarbonate of potash, with an additional quantity of carbonic acid forced into it, and retained by pressure. It is a pleasant form of taking the bicarbonate, and is very likely to tranquillize the stomach, in troublesome cases of vomiting.

POTASSÆ SULPHAS.

Ingredients:

Bisulphate of potash, (which is the salt that remains after the distillation of nitric acid,)
Boiling Water.

By first exposing this salt to heat, one equivalent of sulphuric acid is evolved, and a neutral sulphate remains: this is to be dissolved in water, strained, and the solution evaporated to afford crystals. This salt is anhydrous.

Composition:

1 sulphuric acid	= 40
1 potash	= 48
	88

Qualities. It is insoluble in alcohol, sparingly soluble in water. It produces a yellow precipitate

with chloride of platinum, a white one with chloride of barium. It is insoluble in nitric acid.

Medical Uses. Purgative, and given most frequently with powdered rhubarb. This salt is very hard, and is used sometimes to rub down with other substances, to reduce them to a state of minute division, as well as to modify their action, as in Dover's powder.

Dose. ʒij. to ʒss.

POTASSÆ BISULPHAS.

Ingredients:

The salt which remains after the distillation of nitric acid,
Sulphuric acid,
Boiling water.

By adding the sulphuric acid to this salt, we prevent the decomposition which would take place if it was dissolved in water and evaporated, viz., the bisulphate would be resolved into sulphate and sesquisulphate, and some acid would be taken up by the water. By evaporating this solution, the salt may be procured in crystals.

Composition:

2 sulphuric acid	2×40	$= 80$
1 potash		$= 48$
2 water	2×9	$= 18$
		146

Qualities. This salt is more soluble than the former, it has an acid reaction, and produces effervescence with carbonated alkalies.

Medical Uses. Purgative, but seldom given except in combination with rhubarb, in doses of ʒss. to ʒi. It causes more griping than the sulphate.

POTASSÆ TARTRAS.

Ingredients:

Bitartrate of potash,
Carbonate of potash,
Boiling water.

Decomposition. By boiling these together, one equivalent of tartaric acid quits the bitartrate, leaving it as a tartrate, and combines with the potash of the carbonate, expelling carbonic acid. The tartrate which is in solution by evaporation is procured in crystals.

Composition:

1 tartaric acid	=	66
1 potash	=	48
		114

Qualities. Readily soluble in water. From this solution, almost every acid will precipitate bitartrate of potash, which generally adheres to the vessel. Any thing which is thrown down by chloride of barium or acetate of lead is soluble in nitric acid, shewing that sulphuric acid in no form is present.

Medical Properties. Purgative, generally combined with vegetable purgatives, as rhubarb, senna, &c.

Dose. ʒiij. to ʒvj.

POTASSII BROMIDUM.

Ingredients:

Bromine,
Carbonate of potash,
Iron,
Distilled water.

Decomposition. By first mixing, stirring together, and heating the water, bromine, and iron, the two latter unite to form a bromide of iron.

When to this the carbonate of potash is added, the potash and bromide of iron are both decomposed, the oxygen of the potash unites with the iron, forming oxide of iron, which, with the carbonic acid, forms an insoluble carbonate of iron, the bromine uniting with the potassium forms a bromide of potassium in solution, which, by evaporation, is procured in crystals.

Composition:

1 bromide	= 78
1 potassium	= 40
	118

Qualities. It is entirely soluble in water; it has neither an acid nor alkaline reaction. If pure, chloride of barium does not cause a precipitate in

its solution, shewing there is no sulphuric acid present. When sulphuric acid is added to it, bromine is set free, and will form a yellow colour with starch. It loses none of its weight by heat, as it contains no water. Ten grains of this salt decompose 14.28 grains of nitrate of silver, producing a yellowish precipitate of bromide of silver, which is soluble in ammonia, but very sparingly soluble in nitric acid. If the salt produces a larger portion of precipitate, it is probable that there is in it some chloride of potassium.

Medical Uses. This salt acts on the system in a similar manner to iodide of potassium. Up to the present time it has not been extensively used. It has been found to reduce the size of the spleen in cases of chronic enlargement.

Dose. Gr. iij. to gr. v.

POTASSII IODIDUM.

Ingredients:

Iodine,
Iron,
Carbonate of potash,
Distilled water.

Decomposition. The chemical action which ensues here, is exactly of the same nature as in the former preparation. In the first place there is direct union between the iodine and iron, forming the iodide of iron. When the carbonate of potash is added, the oxygen of the potash combines with

the iron, forming oxide of iron, which falls in combination with carbonic acid: the iodine, with the potassium, forms a soluble iodide of potassium, which, by evaporation, is procured in crystals.

There is another method employed for procuring iodide of potassium, which is generally considered to be preferable, and is described in Dr. Turner's Chemistry. It consists of introducing iodine into a boiling solution of potash; in which case, five equivalents of potash are decomposed, being resolved into iodine and potassium. The five of oxygen, with one of iodine, form iodic acid, and this, with an undecomposed equivalent of potash, forms iodate of potash: five equivalents of iodine unite with five of potassium, to form five equivalents of iodide of potassium. By careful and gentle evaporation, the iodide will crystallize, and the heat will even expel the oxygen from the iodate, leaving a sixth equivalent of the iodide of potassium; or the iodate may be decomposed in the solution, by passing into it hydrosulphuric acid gas, by which the hydrogen of the gas combines with all the oxygen of the iodate, and forms water, sulphur is precipitated, and may be removed by filtration, and iodide of potassium is set free in the liquid.

Composition:

1 iodine	= 126
1 potassium	= 40
	166

Qualities. It is entirely soluble in water and alcohol. It has no effect, or a very slight one on turmeric paper; no action on litmus. It is anhy-

drous, and consequently does not lose weight by heat. When sulphuric acid is added to it, iodine is set free, and produces a blue colour with starch. Ten grains of it are sufficient for decomposing 10.24 grains of nitrate of silver, and the iodide precipitated is partly dissolved by nitric acid, and partly altered in its appearance. This is not the case when ammonia is added.

Medical Uses. This is a very valuable remedy, and is the most available and extensively employed of the salts of iodine. It acts as an alterative, correcting most of the secretions, and has a powerful influence in reducing the size of morbidly enlarged glands. There are many diseases in which it is efficacious, in which there is no definite mode of explaining its operation. It is most serviceable in diseases attacking persons of a scrofulous habit of body.

Dose. Gr. iij. to gr. x., and by some has been extended to ʒj.

LIQUOR POTASSII IODIDI COMPOSITUS.

Ingredients:

Iodide of potassium,
Iodine,
Distilled water.

The iodide of potassium renders the iodine soluble, and is usually given with it in solutions.

Each ounce of this solution contains half a grain of iodide of potassium, and a quarter of a grain of iodine.

Dose. ℥ss. to ℥ij.

POTASSII SULPHURETUM.

Ingredients:

Sulphur,
Carbonate of Potash.

Decomposition. When these substances are heated together, the carbonic acid is first expelled, and three-fourths of the potash are decomposed, and resolved into oxygen and potassium; the oxygen combines with a fourth of the sulphur, to form sulphuric acid, which, with the undecomposed potash, forms sulphate of potash; the remaining sulphur combines with the potassium, forming sulphuret of potassium; the resulting substance is a mixture of one equivalent of sulphate of potash, and three of sulphuret of potassium.

Qualities. When recently broken, it has a yellowish brown colour. Dissolved in water, or almost any acid, it emits an odour of hydrosulphuric acid. Its solution in water is yellow. The precipitate thrown down by acetate of lead is at first red, afterwards black. By long keeping, it is decomposed, and by absorbing oxygen, is converted into sulphate of potash, and no longer will

evolve hydrosulphuric acid when treated with water or acids.

Medical Uses. This substance is not given internally, at present. It is employed in the form of baths or lotions in some skin diseases, and especially the itch.

SODÆ CARBONAS.

This may be procured from the impure soda, known as kelp and barilla. By solution and straining, most of the impurities are removed; and by evaporation, the salt is to be obtained in crystals. From kelp there is a portion of liquid remaining, which contains iodine, and which is known by the terms soapmakers' lees, or mother liquors. Almost all the carbonate of soda in this country is now prepared by decomposing common salt, and sulphate of soda.

Composition :

1 carbonic acid		= 22
1 soda		= 32
10 water	10 × 9	= 90
		144

Qualities. Recently prepared, it is translucent, but soon effloresces in an open vessel. It is entirely soluble in water, but not in alcohol. It changes the colour of turmeric, like alkalies.

Medical Uses. It is antacid, and, combined with acids, forms aperient compounds. It is much prescribed in fevers, with some acid, to act as a refrigerant, and, when taken in effervescence, tranquillizes the stomach. It is also prescribed in the uric acid diathesis, and in scrofula.

Dose. Gr. x. to ʒss.

SODÆ CARBONAS EXSICCATA.

In this preparation 38 parts per cent. of water are driven off, that it may be administered in the form of powder or pills. The dose is rather less than of the former.

SODÆ SESQUICARBONAS.

This is made by transmitting carbonic acid through a solution of the carbonate to saturation; the solution is then evaporated, and the salt is obtained in a crystalline state.

Composition:

1½	carbonic acid	=	33
1	soda	=	32
2	water	2 × 9 =	18
	Atomic number ...		83

Qualities. It is entirely soluble in water. In

this solution, chloride of platinum occasions no precipitate, nor does sulphate of magnesia, until heat be applied to expel the excess of carbonic acid. If heated, some carbonic acid will be expelled, and dried carbonate of soda remains.

Medical Uses. As the carbonate, and in similar doses.

SODÆ SULPHAS.

Ingredients:

The salt which remains after the distillation of hydrochloric acid,
Carbonate of soda,
Boiling water.

Decomposition. Any excess of acid remaining with the sulphate is saturated by the soda of the carbonate; carbonic acid is evolved, and the neutral sulphate is procured in crystals by evaporation.

Composition:

1 sulphuric acid		= 40
1 soda		= 32
10 water	10 × 9	= 90
		162

Qualities. It effloresces by exposure to air. It is entirely soluble in water, not at all in alcohol. It has no action on litmus or turmeric. Nitrate of silver causes scarcely any precipitate in a dilute solution of it; nitrate of baryta, a very copious

one of sulphate of baryta, which is insoluble in nitric acid. By heat, 55 parts per cent. are lost, being the water.

Medical Uses. A mild, cooling purgative, less offensive to the taste than sulphate of magnesia.

Dose. ʒss. to ʒj.

SODÆ POTASSIO-TARTRAS.

Ingredients:

Bitartrate of potash,
Carbonate of soda,
Boiling water.

Decomposition. One equivalent of acid in the bitartrate saturates the soda, expelling carbonic acid, and a neutral salt remains.

Composition:

1 tartrate of potash	=	114
1 tartrate of soda	=	98
8 water	8 × 9 =	72
Atomic number		284

Qualities. It is entirely soluble in water, and affords no precipitate with chloride of barium or nitrate of silver, proving the absence of any sulphate or hydrochlorate. It produces no effect on litmus or turmeric. If sulphuric acid be added, some bitartrate of potash is formed.

Medical Uses. It is a cooling saline purgative, most agreeably taken in the form of the Seidlitz Powder.

Dose. ʒij. to ʒvj.

LIQUOR SODÆ EFFERVESCENS.

This is a solution of sesquicarbonate of soda, with excess of carbonic acid forced into it and retained in it, by pressure.

LIQUOR SODÆ CHLORINATÆ.

Ingredients:

Carbonate of soda,
Distilled water,
Chloride of sodium,
Binoxide of manganese,
Sulphuric acid.

In this preparation the carbonate of soda is first dissolved in water: then the chloride of sodium and binoxide of manganese are put into a retort, and sulphuric acid is added to them, for the purpose of setting free some chlorine.

When these three ingredients are mixed, the following decomposition is, by most chemists, supposed to take place. The binoxide of manganese parts with one equivalent of oxygen, which passes

to the sodium, to form soda, and set free one equivalent of chlorine; the sulphuric acid combines with the soda and protoxide of manganese, forming sulphates with those bases, and, by heat, chlorine is driven off.

The chlorine is first made to pass through five ounces of water, that any hydrochloric acid which may escape should be absorbed; the gas then passes into the solution of carbonate of soda with which it combines. The precise chemical nature of this liquid is not ascertained. It was presumed by Dr. Turner, to be a solution of bicarbonate of soda and chloride of sodium in combination. It is called by Berzelius a chlorite of soda.

This liquid, very similar to Labarraque's soda disinfecting liquid, has a pale straw colour, a sharp saline astringent taste; it first reddens, then bleaches turmeric paper. It is little affected by heat; by careful evaporation it may be procured in crystals. By spontaneous evaporation chlorine is evolved, and carbonate of soda alone remains.

Medical Properties and Uses. It is chiefly employed externally, though occasionally given internally. The cases suited for its external use are gangrenous and ill-conditioned ulcers, carbuncle, cancer, ozœna, gangrene, putrid sore throat. It is in such cases applied, diluted, either in the form of lotion, poultice, or on lint. In cases of salivation, diluted with eight or ten parts of water, it forms a good mouth-wash. Still more diluted, it is injected with advantage in cancer of the uterus. It has also been employed with much benefit in Tinea capitis, and some herpetic affections.

Internally it has been given in typhoid fevers,

scarlatina maligna, in dysentery with fetid stools, in dyspepsia with fetid eructations, in doses of 15 to 20 minims in an ounce or two of water.

As a disinfecting agent it acts by the chlorine being gradually evolved, which combines with the hydrogen of offensive gases, and thus destroys their fetid odour. It is more expensive than chloride of lime, and consequently is less used.

ZINCI OXYDUM.

Ingredients:

Sulphate of zinc,
Sesquicarbonate of ammonia,
Distilled water.

Decomposition. The sulphuric acid, by its greater affinity, combines with the ammonia, forming a soluble sulphate; a portion of carbonic acid, with the oxide of zinc, forms an insoluble carbonate, which is precipitated. When the carbonate is heated, the carbonic acid is evolved, and the oxide remains.

Composition:

1 oxygen	= 8
1 zinc	= 32
Atomic number	40

Medical Uses. Tonic, not often prescribed for internal use.

Dose. Gr. j. to gr. iij.

It is more used as a tonic and stimulating application to ulcerated surfaces, in the form of the unguentum zinci.

ZINCI SULPHAS.

Ingredients:

Zinc,
Dilute sulphuric acid.

Decomposition. A portion of the water is decomposed; its oxygen combines with the zinc, to form oxide of zinc, and hydrogen gas escapes; the acid then seizes on the oxide of zinc, forming the sulphate in solution, which, by evaporation, is procured in crystals.

Composition:

1 sulphuric acid		= 40
1 oxide of zinc		= 40
7 water	7 × 9	= 63
Atomic number		143

Qualities. It is entirely soluble in water. In this liquid, solution of ammonia throws down a white precipitate, viz. the oxide of zinc, soluble in excess of ammonia. Chloride of barium produces a copious white precipitate of sulphate of baryta; and acetate of lead causes a white sulphate of lead to be thrown down. Hydrosulphuric acid, also, occasions a white precipitate.

Medical Properties. Tonic and astringent, in small doses; in larger doses, emetic. It is frequently used as an eye-wash, and as an injection in gleet and leucorrhœa.

Dose. As a tonic, gr. j. to gr. v.
Emetic, ℈j. to ʒss.
And in cases of poisoning, as much as a drachm might be given.

MISTURA FERRI.

Ingredients:

Myrrh,
Carbonate of potash,
Rose water,
Sulphate of iron,
Spirit of nutmeg,
Sugar.

Decomposition. The chemical change which occurs here is one of double elective affinity. The sulphuric acid combines with the potash, forming a soluble sulphate of potash, whilst the carbonic acid unites with the iron, forming an insoluble carbonate of iron, which is suspended in the mixture by the myrrh. When carefully prepared, this mixture is at first green, and contains protoxide of iron, more efficacious than the sesquioxide. By keeping, and exposure to the air, the iron passes into a state of sesquioxide, and the mixture changes its colour from green to a dirty brown.

There is not more than one grain of oxide of iron in each ounce and half.

Medical Properties. Tonic and emmenagogue, most frequently prescribed in chlorosis.

Dose. ℥j. to ℥ij.

PILULÆ FERRI COMPOSITÆ.

Ingredients:

Myrrh,
Carbonate of soda,
Sulphate of iron,
Treacle.

Decomposition. The sulphate of iron and carbonate of soda decompose each other; the sulphuric acid unites with the soda, forming sulphate of soda, and the carbonic acid, with the oxide of iron, forming carbonate of iron. When first prepared, this pill contains the protoxide of iron, and may be useful; but by keeping, it soon becomes sesquioxide, and is then of little service.

Medical Uses. The same as of the mistura ferri comp.

Dose. Gr. v. to gr. xv.

PILULÆ HYDRARGYRI.

Ingredients:

Mercury,
Confection of red rose,
Liquorice.

In this preparation, the mercury appears only to be minutely divided: although some still entertain an opinion that the mercury is partially oxidized.

Medical Uses. It is one of the mildest forms of mercury for internal use, and is generally prescribed as an alterative. Given with chloride of mercury, the activity of each is increased.

Dose. Gr. v. to gr. xv.

ALCOHOL.

Ingredients:

Rectified spirits,
Chloride of calcium.

Rectified spirit is alcohol with water. The chloride of calcium, having a strong attraction for water combines with it, and the spirit, by distillation, passes over, of a lighter specific gravity.

Alcohol is a compound of

3 hydrogen	3 × 1 =	3
2 carbon	2 × 6 =	12
1 oxygen	=	8
	Atomic number	23

Or it may be called a compound of one equivalent of olefiant gas, and one of water.

Alcohol is obtained from sugar by the vinous fermentation. By this process the sugar loses carbon and oxygen in the proportions for forming carbonic acid, and is resolved into alcohol, as may be explained in the following manner.

	hydrogen.	oxygen.	carbon.
Sugar contains	3	3	3
Subtract 1 atom of carbonic acid		2	1
The result will be, 1 atom of alcohol,	3	1	2

Sp. gr. of absolute alcohol	°796
,, Alcohol of the Pharmacopœia	815
,, Rectified spirit	838
,, Proof spirit	920

Proof spirit is made by mixing together 5 pints of rectified spirit, with three pints of distilled water at 62.

SPIRITUS AMMONIÆ.

Ingredients:

Hydrochlorate of ammonia,
Carbonate of potash,
Rectified spirit,
Water.

Decomposition.—The hydrochlorate of ammonia and carbonate of potash are decomposed. The carbonic acid combines with the ammonia, forming a soluble protocarbonate of ammonia; the chlorine of the hydrochloric acid unites with the potassium, forming a chloride of potassium in solution, and the oxygen with the hydrogen forms water.

By heat, the carbonate of ammonia being volatile, passes over with the liquid into a receiver.

Composition of carbonate of ammonia:

1 carbonic acid	= 22
1 ammonia	= 17
Atomic number	39

Sp. gr. of this solution, .860.

Medical Uses.—It is a diffusible stimulant, and antispasmodic, given in doses of ʒss. to ʒij. in a wine-glassful of water.

SPIRITUS AMMONIÆ AROMATICUS.

There is the same chemical action in this as in the preceding preparation. It is, in fact, a solution of protocarbonate of ammonia, in spirit and water, with the addition of some aromatics. It is used in a similar manner, and like doses.

Sp. gr. .914.

SPIRITUS AMMONIÆ FŒTIDUS.

This also is a solution of carbonate of ammonia, in water and spirit, with assafœtida. It is more frequently prescribed in hysterical and spasmodic affections.

Sp. gr. .861.

Dose.—℥ss. to ℥jss.

SYRUPS.

Syrups should be kept where the temperature does not exceed the 55th degree of Fahrenheit's thermometer, otherwise they will undergo the vinous, and subsequently the acetous fermentation.

The only syrup requiring particular notice is

SYRUPUS PAPAVERIS.

If this syrup be carefully prepared, its strength is such that three drachms of it are equal to one grain of opium; generally it is much weaker, and with most druggists is imitated by other formulæ, such as introducing tincture of opium into it, or the extract of white poppy. This syrup is very liable to ferment, in which case the generated acetic acid is supposed to give it increased activity. From all these circumstances the syrup cannot be depended upon, and is unworthy a place in the pharmacopœia.

CHEMICAL NOTES.

CHEMISTRY is a science which investigates and teaches the qualities of bodies, both in a simple and compound state.

The earth and its inhabitants, with the natural objects surrounding us, are compounds of a small number of simple bodies or elements, in very variable proportions, which are kept in a state of combination by peculiar forces, called affinities or attractions. These attractions are of three kinds, named attraction of aggregation or cohesion, chemical attraction or affinity, and attraction of gravitation.

Attraction of cohesion is a force exerted between similar particles, (that is, such as have uniform properties,) and only gives increase to the bulk of the substance.

By this power, bodies may be solid, liquid, or aeriform, according to the force of the cohesion keeping them together. The most beautiful illustration of this attraction is seen in crystallization.

Particles of bodies are spoken of as *integrant*, *component*, and *elementary*.

The integrant particles are any small portions of a large substance, such as a lump of chalk. If this be minutely divided, every particle of it is still carbonate of lime, and is named an integrant particle.

This particle of chalk, by analysis, is found to

consist of carbonic acid and lime, each of which is named a constituent or component particle.

Carbonic acid and lime are also compounds, the former of carbon and oxygen, the latter of oxygen and calcium; and the bodies thus separated, are named elementary particles.

Chemical attraction acts by uniting bodies, or particles of a dissimilar nature; and, by the union of two forming a compound, frequently not possessing a single property of either of its components.

There are numerous modifications of this affinity, of which the following are the most prominent.

Affinity does not exist in the same degree in all bodies, in respect to each other, but has always an individual preference. This has been called elective affinity, because bodies appear constantly to select those for which they have the greatest attraction. Thus, if sulphuret of mercury and iron filings are mixed and heated together, the sulphur quits the mercury and combines with the iron, and the mercury is set free in its simple state.

A second difference is found to depend upon the relative quantities of bodies which act upon each other; thus, a body possessing less affinity than another, but existing in larger quantity, may overcome the attraction of the more powerful one, or, in other words, quantity may sometimes overbalance affinity.

The different degree of cohesion of several bodies is another source of modification; thus, the tendency to assume the aeriform state may overcome the disposition to combination, even when the elements disposed to unite are present in large quantities.

A fourth modification of chemical affinity is

exhibited when two compound bodies, by mixing, act upon each other, and produce an interchange of elements; as, when the sulphate of magnesia and carbonate of potash are brought in contact, there is an exchange of acids, and sulphate of potash with carbonate of magnesia are the products: this kind of action is called double elective affinity, or attraction.

The causes of these changes are not satisfactorily understood, but possibly may depend, in a great degree, on the opposite electrical states of elementary atoms.

Attraction of gravitation is that force which all bodies mutually exert on each other at a distance. The example most familiar to us, is the falling of a body towards the earth's surface; this tendency is also shown when a body is raised from that surface, and produces the effect which we call weight.

This is but a particular case of the universal attraction; for by the investigation of mathematicians and astronomers, it has been discovered, that all the heavenly bodies exert a mutual action of this kind on each other.

Material substances not only possess chemical but also physical properties, which are of two kinds, general and secondary.

The general properties are,

Extensibility,
Impenetrability,
Mobility,
Divisibility,
Gravitation,
Porosity,
Indestructibility.

Extensibility implies the occupation of space, in reference to length, breadth, and thickness.

Impenetrability means that two particles of a body cannot be made to occupy the place of one at the same time.

Divisibility, to an extreme degree, is known to exist, and supposed by some to have no limits; at all events, as far as our present means and senses can ascertain. By supposing a limit to the divisibility, we are naturally led to the atomic theory, which will be subsequently noticed.

Porosity implies that bodies consist of particles, between which spaces exist, as all of them admit of reduction of bulk by diminished temperature or mechanical action; and, as matter is incompressible, reduction of size would be impossible without porosity; and this property of matter necessarily results from the atomic hypothesis.

Indestructibility. Bodies may be decomposed, and apparently dissipated, and lost to sight, but are not lost to existence. They only pass into new forms and combinations, and still retain the general qualities of matter. This is impenetrability, expressed in another form.

The secondary properties of matter are

Opacity,
Transparency,
Elasticity,
Softness,
Hardness,
Colour,
Density,
Fluidity,
Solidity.

Most of the above terms are sufficiently clear, as to require little explanation.

By *Elasticity* we understand that the particles of a body may be separated or driven closer to each other by some force, and return immediately to their former situation as soon as that force is withdrawn. Thus, a gas may be compressed into a less space, but will immediately expand to its former bulk as soon as the pressure is removed. A piece of Indian rubber admits of being elongated by force, which being withdrawn, allows it to regain its former shape and dimensions.

Density, *solidity*, *hardness*, and *fluidity*, refer to the consistence of bodies, and will depend upon the number of particles and the distance betweeen them. In solids, the particles are most numerous, and the spaces between them are imperceptible; the different cohesion between them will produce varied degrees of hardness. There is in bodies a power opposed to cohesion, named repulsion, which is less in solid than in liquid or gaseous bodies.

Liquids are fluids, of which the upper surface of the retaining vessel may be open or free; but gases are fluids, which require a closed vessel to retain them.

When liquids are retained in a vessel, the upper surface is horizontal; thus, the surface of small lakes may be called horizontal; but in any large expanse of water, the surface will be like the ocean, sensibly curved.

Where a liquid, in small quantity, is kept in close space, it is found to disappear under a proper temperature. If we reduce the temperature, or increase the pressure, sufficiently, the liquid will again reappear. In its former, or invisible state, it is said to be vapour; and the quantity present

in any space, will depend on the pressure and temperature.

From the fact of the condensation of gases, discovered by Mr. Faraday, it is concluded that the fluids, designated by the term *permanent gases*, are the vapours of liquids, which can only exist as such, under low temperatures, or high pressures, or both conjointly.

Inertia is that property by which matter is rendered incapable of altering its state, whether of rest or of motion. Hence, when a body at rest changes its state to one of motion, or when a moving body changes the direction of its motion, this can only be in virtue of some extraneous force; all bodies are capable of being put in motion. This is commonly known as mobility.

DIVISION OF BODIES.

Most animal, vegetable, and mineral substances, may be decomposed and resolved into what are called proximate principles, such as albumen, gelatin, tannin, gallic acid, oxides, &c.; and these again can be resolved into separate and distinct substances, which admit of no further decomposition, and are therefore called ultimate elements. Cinnabar, or sulphuret of mercury, may be resolved into sulphur and mercury, which, by our present knowledge of chemistry, are incapable of further decomposition.

In tables of simple bodies are found a number of substances which want many of the principal

qualities of the others; on which account, it is doubtful whether they should be classed amongst material substances. Many consider them as only qualities of bodies to be found in them under certain circumstances.

The chief difference between them and other bodies is, that they are imponderable.

They are three in number, viz. light, heat, and electricity; but as these are intimately connected with each other in many points of view, it is far from improbable that they are only degrees or modifications of one universal principle.

SIMPLE IMPONDERABLE BODIES.

LIGHT.

The sun is the great source of light and heat, which are constantly emanating from it, and constitute what we call the solar rays.

Light travels with such rapidity, that it occupies about eight minutes in reaching the earth, a distance of 95 millions of miles, at the rate of 195,000 miles in a second. It moves in straight lines, but at the same time becomes attenuated, so that, the intensity of light diminishes in an inverse ratio of the square of the distance from the sun.

When the solar rays fall on a body, they become reflected from its surface, and render it visible. The angle at which they are reflected is equal to the angle of incidence.

Some bodies allow these rays to pass through them without alteration, and are thence called conductors of light; but, in common terms, are said to be transparent or diaphanous.

The solar rays, in penetrating the interior of transparent bodies, deviate from the straight line, and undergo different inflexions, according to their density, combustibility, or condition of their surface.

If the rays pass from a rare into a dense medium, as from the air into the water, they approach to the perpendicular at their points of immersion; but, if they pass from a dense to a rare medium, they are turned from the perpendicular. This deviation from the original direction is called refraction. On this principle is explained the familiar experiment of putting a piece of money into a basin, and stepping back, that the edge just conceals it from sight; if water is poured into the vessel, the money again becomes visible.

Density is not alone concerned in producing refrangibility of the rays: combustible bodies possess this property in the most powerful degree, as the diamond, hydrogen gas, naphtha, &c.

Decomposition of the Solar Rays.

When the solar rays are made to enter a dark chamber by a small aperture, and they are received upon a glass prism, behind which is white paper spread out at a certain distance, an elongated figure, composed of a number of colours, is obtained, called the solar spectrum. The colours

seen in it are red, orange, yellow, green, blue, indigo, and violet.

These colours gradually merge one into the other, so that in fact there are not seven only, but an infinite number of colours, passing from the extreme red to the extreme violet.

These rays differ from each other in certain respects; thus, the greatest heat is found to be produced in the red, and to decrease progressively down to the violet. For, if the rays are made to fall upon a flat surface, and a thermometer be placed in each, it is found that the mercury rises highest in the red rays.

Non-luminous calorific rays exist beyond the red, and seem to produce a still more powerful effect upon the thermometer; but the fact is, the place of maximum heat depends on the nature of the refracting prism.

This phenomenon proves that the solar rays, by passing through the prism, are separated into calorific and colorific. The decomposition of white light arises from the unequal refrangibility of the colorific rays.

The violet end of the spectrum is ascertained to be greatly concerned in acting chemically upon bodies. If chloride of silver, which is of a beautiful white colour, be exposed to the violet rays, it speedily becomes black, whereas in the other end of the spectrum it undergoes no change. Some consider that the violet rays produce the oxidation of metals, and that the red rays serve to promote their reduction to the metallic state.

The colours of bodies are owing to a decomposition of the solar rays, their surface reflecting certain rays, but absorbing or retaining the rest.

Thus, a red substance reflects the red rays and absorbs all the others. The infinite variety in the combinations of the reflected rays gives rise to the surprising diversity of colours.

Black objects absorb all the rays, reflecting none. White objects reflect all the rays, and absorb none.

To show that white bodies reflect all the rays, a pretty experiment has been instituted. If a piece of paper be painted in compartments with the seven prismatic colours, and then rotated rapidly, it assumes a white appearance.

Opaque bodies, which absorb light, become heated; hence it is warmer on land than on the sea.

From a knowledge of this fact, instruments have been employed to ascertain the quantity of light. For this purpose two thermometers are employed, of which the tube of one is to be blackened. If both are exposed to light, the mercury rises highest in the black one, and its elevation in a given time indicates how much the rays have been decomposed in producing that temperature.

The instrument employed to measure the intensity of light, is called a photometer. By its assistance, Leslie has calculated that the intensity of solar light is 12,000 times greater than that of a candle; that is to say, a portion of sun, of the size of the flame of a candle, would give as much light as 12,000 candles.

Combustion affords rays very like those emanating from the sun, but infinitely less dense, and less intimately combined with the heat which they contain. This is readily ascertained by standing before a bright fire in the winter, when heat is

felt at a considerable distance, although the air of the room is not heated; again, ice on the windows may be melted by the rays, whilst water, placed in the shade, between them and the fire, freezes.

It is found that luminous rays can exist without the accompaniment of any sensible heat, as in the rays passing through a lens, and as is observed in the light from the moon, which seems to have absorbed all the heat, and reflects light deprived of its heating property. Many bodies, as some living animals, and vegetables during putrefaction, also some minerals, &c., give out light, without combustion. The source of such light is quite unintelligible.

Luminous rays exert a considerable influence upon the composition of bodies. The most general effect is, to reduce oxidized bodies to their primitive simple state, by setting free the oxygen. This is seen in nitric acid, which by exposure to light loses part of its oxygen, and is reduced to nitrous acid.

Light also renders pale and destroys vegetable colours, as we often observe, when silks or stuffs are exposed to its influence. Many have thought that this depends on its heating properties, for many colours which resist the light for some time, if heated beyond the temperature of boiling water, have become pale in some minutes.

Light is useful, and indeed necessary, to vegetable and animal life. In the former it operates by decomposing its carbonic acid, fixing the carbon, and setting the oxygen free.

There are two theories of the nature of light, named *corpuscular* and *undulatory*. The former was advocated by Newton, who supposed that

light was a very subtile matter, which, like heat, entered into bodies; and in the eye, actually came in contact with the retina.

Dr. Young supported the undulatory theory, which is generally received at the present time. This supposes that the universe is pervaded by a very subtile ether or fluid, which penetrates into the most dense substances; and that light, by striking against its particles, throws them into motion, which is imparted from one to the other, like tremors of the air causing sound, and producing colours, varying with the length of the luminous wave, the intensity of which depends on the rapidity of the impulse.

Still it is impossible to demonstrate what light is, whether it is a separate substance, or a combination of chemical rays. When it is absorbed by opaque bodies it totally disappears, and such bodies exposed to it for years, receive no increase in weight; nor does the sun suffer the least apparent diminution in its illuminating power, after diffusing its rays during so many ages.

CALORIC.

Caloric is the word usually employed in chemistry to denote that substance or quality which is commonly called heat. We are acquainted with it in two states, which are named *latent* and *free*. To the former condition some restrict the term caloric, to the latter that of heat. It is the most active agent in nature, and exists in all bodies in

various proportions, being least in solids, in the greatest quantity in gases, and in an intermediate degree in liquids.

Free or uncombined caloric constitutes temperature, the degree of which is ascertained by its effects on bodies, causing expansion or increase of their volume. This expansion is attended likewise by change of form: thus, by its means, solids are converted into liquids, and liquids into vapours, the degree of dilatation increasing with the temperature. The expansion of solids may be illustrated by taking a metallic rod, which in the cold state will pass through a ring exactly fitted to it: if the rod be heated, it is found that it will no longer pass through the ring, but on becoming cold, it will resume it normal dimensions.

The expansion of fluids may be seen, by taking a common thermometer and applying heat to the bulb, when the mercury will rise in the tube, and occupy an increased space. The expansion of gases may be readily proved, by filling a bladder with common air, and placing it near the fire; the heat, by expanding the gas, causes the bladder to burst.

Solids and liquids are found to expand in unequal ratios; solids expanding least, liquids more, gases most. Gases have been discovered to expand in an equal ratio in respect to each other, in the proportion of $\frac{1}{480}$th of their volume for every degree of Fahrenheit, commencing at 32 degrees: so that a gas must be heated to about 500 degrees to have its volume doubled, or 480 degrees higher than any other given point. All bodies, by being expanded, become of lighter specific gravity. On the principle of expansion

by heat, we explain the breaking of glasses by pouring hot water into them, especially in winter. The glass being a bad conductor of heat, the inner particles expand before the outer ones can be affected; a separation of them consequently takes place. Expansion by heat is observed to affect the rate of going of clocks, by producing an elongation of the pendulum, and the vibrations being necessarily fewer. Thus, clocks are found to lose in summer and to gain in winter.

The quantity of heat which is set free in any situation is ascertained by an instrument called a thermometer, which may be defined to be a measurer of heat or expansion, that is, the quantity of free caloric is judged of by the increase of volume given to fluids contained in this instrument. The liquids employed in thermometers are mercury, alcohol, and air. The latter is most delicate, and most easily affected. Alcohol is used to ascertain very low temperatures, because there is no satisfactory account of its ever having been frozen. Mercury is preferable for moderate temperatures, remaining liquid in a more extensive range of temperature than any other fluid, and expanding with a greater degree of regularity.

A thermometer is made with a glass tube, having a bore through it of equal diameter. One end is then to be melted, and air blown in from the cool end, to form a bulb. The bulb and tube are then heated to expel the air, and in that state the open end is introduced into mercury: on cooling, the mercury is found to have ascended in the tube and the bulb. This heating and immersion in mercury is repeated until the bulb is filled, and the mercury extends a third or half-way up the

tube. Heat is again applied to expand the mercury and drive out all the air, and when the mercury has reached the top, a flame is directed upon the open end of the tube by means of a blowpipe, until the glass melts and the orifice is closed, or, in other words, it is hermetically sealed. The next stage in the process is to graduate it. This is done by immersing the bulb in water, formed during the melting of ice or snow, the temperature of which is taken as 32 degrees, and in Fahrenheit's scale is called the freezing-point of water: a scratch is then made at the point, to which the mercury descends. The bulb is subsequently to be immersed in boiling water, to the depth of about two inches, and another scratch made on the tube at the point to which the mercury ascends. This is termed the boiling-point. The intermediate space is to be equally divided into 180 degrees, thus making the boiling-point 212 degrees. The zero point of Fahrenheit's Thermometer is 32 degrees below the freezing-point, because Fahrenheit imagined that no greater degree of cold existed, or could be produced. In the centigrade scale the freezing-point of water is taken as zero, and the boiling-point 100; in the scale of Reaumur the zero is taken as the freezing-point of water, and 80 as the boiling-point.

High temperatures are ascertained by instruments called pyrometers, amongst which that of Mr. Daniell is by far the most in use.

Wedgwood's pyrometer consisted of a metallic groove, in which was introduced a quantity of a particular species of clay. By the application of heat the water was expelled, the clay passed into

a state of fusion, and contracted in proportion to the elevation of temperature.

The highest temperature supposed to have been ascertained is about 32.000. Some experiments give the greatest heat as about 24.000. Professor Daniell considers that these calculations are far too high, and makes the greatest heat of his scale not to exceed 4.000.

Heat is conveyed or passes from one body to another, by radiation and conduction. By the conduction of heat is understood the power by which heat passes from particle to particle, until they have all attained the same temperature; and, according as the particles transmit, receive, or part with their heat with more or less rapidity, they are called good or bad conductors.

The best conductors are the metals, and most bodies possessing much density.

Amongst the bad conductors are gases, water, silk, wool, down, fur, charcoal, glass, &c.

Radiation is that property by means of which heat is evolved, or flies off from bodies in straight lines, like light, in every direction. This is presumed to occur at all temperatures; but heated bodies near colder ones radiate more than they receive, as there is always a tendency to obtain an equilibrium.

Bodies part with their heat by radiation with unequal degrees of rapidity.

The best radiators of caloric are bodies having a dark and rough surface. Those of a light colour, smooth, and polished, part with their heat less speedily, and are called bad radiators. This may be illustrated by taking a square vessel with the

sides presenting different surfaces, that is, one rough and black, another polished, another white, and a fourth of some dark colour.

If hot water be poured into this vessel, and a thermometer is placed at an equal distance opposite each surface, the fluid in the thermometer opposite the black one will be found to rise highest, that opposite the polished surface will be least affected.

There is an illustration of the same fact even in making tea. If a silver polished teapot is used, the water will retain its heat longer, and extract more of the soluble matter; on the other hand, if a black and rough teapot be used, the tea will be weaker; but to persons who take numerous cups, and make several infusions on the same leaves, the black teapot is found preferable, as the last cup is almost as good as the first.

The formation of dew is explicable on the principle of the radiation of caloric. During fine and cloudless weather, after sunset, the earth, radiating its caloric, and receiving none in return, becomes colder than the surrounding medium. The watery vapour held in solution and suspension in the atmosphere, by coming in contact with the cold surface, is condensed upon it. If there be clouds the heat radiated from the earth is returned to it again, so that there is little reduction in temperature, and consequently little condensation of the watery vapour.

The snow affords a great protection to vegetation by preventing radiation, that is, preserving the earth from any great diminution of its temperature.

If a similar quantity of two bodies be exposed

to a given temperature, it is found that they vary in the time required to reach that temperature, also in the time they take to cool and in the quantity of heat evolved whilst that change is taking place. Thus, water requires twenty-three times as much heat to raise it to a given point as mercury. The heat which thus enters the body is called specific caloric.

This fact is shown by the calorimeter, an instrument containing a frame or cage of ice, in which a certain quantity of ice or snow is introduced. To this the heated body is added, and the relative quantity of ice or snow melted by the substance whilst cooling, is considered to prove the difference of the quantity of heat absorbed.

The solid is considered to be the natural state of bodies, which become liquids, or vapours, according to the quantity of caloric combined with them. Liquefaction is one of the forms of expansion which is ordinarily accomplished by heat; still the conversion of a solid into a fluid is attended with a disappearance of caloric, or, in other terms, the production of cold. The substance is said to have acquired an increased capacity for caloric.

This increased capacity for caloric is the cause of cold being experienced on the tops of mountains, and when an ascent is made in a balloon. The higher a person rises, the colder he feels, from the circumstance of this capacity for heat increasing, and the heat being abstracted from the body. The ratio in which temperature diminishes, is estimated at one degree for every 350 feet. This explains why lofty mountains are covered by perpetual snow and ice.

The heat, which becomes latent during the con-

version of a solid into a liquid, is called the caloric of fluidity, or latent heat of the liquid.

The latent heat of water is estimated at 140 degrees, of which fact the following is an illustration. If a pound of ice at 32 degrees be mixed with a pound of water at 172, the ice will be melted; but the temperature of the mixture will be only 32. The reason of it is this: during the melting of the ice, 140 degrees of heat enter between the particles of the ice, making it liquid, the heat itself becoming latent. But if a pound of water at 32 be mixed with a pound of water at 172, the temperature of the mixture will be intermediate, that is, 102.

Liquids would be constantly and rapidly converted into vapours, if there were not some power to resist such a change. This power, under ordinary circumstances, is the pressure of the atmosphere. This pressure is considered as equal to 15 pounds upon every square inch, but is liable to variation at different times and at different elevations. The pressure of the atmosphere is estimated by the barometer. This instrument is constructed upon the principle, that the atmospheric pressure can support a certain column of mercury or of water: the column of mercury is 30 inches at the level of the sea, the column of water 34 feet. In proportion as we ascend in the atmosphere, or the more we become elevated above the level of the sea, the less becomes the pressure, and the smaller is the column of the mercury which can be supported. The difference which is made in such cases is found to be about one inch in the column of mercury for every 830 feet.

If the pressure upon liquids be diminished they evaporate more speedily, and more easily are made to boil: some liquids may be made to boil at the freezing-point of mercury, if the atmospheric pressure be taken off them. Ether boils in vacuo at about 40 below zero. Liquids in general boil at 140 degrees lower in vacuo than under the pressure of the atmosphere; thus water in vacuo boils at 72.

The boiling-point of water diminishes as we ascend a mountain in the ratio of one degree for every 530 feet in elevation. Water boils at Mexico below 200, and at the top of Mont Blanc at 186. On the contrary, if we could descend much below the surface of the earth, the boiling-point of fluids would be found to be much increased.

The sources of heat are considered to be six. They are: the Sun's rays, Combustion, Mechanical action, Electricity, Chemical action, and Animal heat.

The sun's rays are composed of light and heat, which are separated when they reach the surface of the earth. The heat thus set free produces varieties of temperature on different parts of the globe. The average heat is estimated at 50, the highest 120, the lowest about 50 degrees below zero.

Combustion, in the ordinary acceptation of the term, is the rapid union of oxygen with a combustible body, attended with an evolution of light and heat.

Mechanical action includes friction and percussion, by which intense heat is evolved. Of this there are numerous illustrations, as, by rubbing

pieces of wood together, ropes and pullies, axle-trees of carriages, and even forests are set on fire by the branches of trees rubbing together.

Heat is considered to be chemically evolved during the fermentations, and when fluids by admixture become condensed. On the principle of fermentation is explained the spontaneous combustion of hay-stacks; and by the force of condensation is produced the combustion which sometimes takes place when tow and cotton, moistened with linseed oil, are exposed to the atmosphere.

By *animal heat* is understood the temperature of the body, which is supported by the action of the vital functions. The changes in the blood by respiration are imagined to be the chief causes of the evolution of heat.

Cold was supposed at one time to be a positive body, like heat, but is now considered to be only negative, or, in other words, the absence of caloric. It is always produced by rarefaction, that is, when a body is converted from a dense to a rarer state.

Thus ether or spirit placed upon the hand passes into vapour, or a rarefied state, acquiring an increased capacity for caloric; free caloric is absorbed from the hand, and cold is experienced.

When snow and salt are mixed together, they pass into a liquid or rarefied state, and heat is abstracted from any contiguous body. On this principle cold is always generated by freezing mixtures. There are several experiments with the air-pump to show the freezing of water at ordinary temperatures.

If a little cup of water and another of ether be put into the air pump, and the air be withdrawn,

the removal of atmospheric pressure will cause the ether to boil and vaporize; its vapor acquiring an increased capacity for heat, abstracts free caloric from the water, which, by losing its heat, freezes. The water may be made to freeze without the presence of ether, by substituting some sulphuric acid, or something that has a great attraction for water. By exhausting the air, part of the water will rise into vapour, and, from its rarefied state, will absorb sufficient heat from the water in the vessel to cause it to pass into a solid. The sulphuric acid is intended to absorb the vaporized water.

ELECTRICITY.

Electricity is the name of a science which teaches the laws, properties, and phenomena of an imponderable agent, called the Electric Fluid.

If a piece of sealing-wax be rubbed upon the coat-sleeve, it will be found to attract light bodies, such as small pieces of paper, and is said to be electrified; and particles thus attracted will afterwards fly off actively from it, by a property called electric repulsion.

There are two theories of the nature of the electric fluid, some contending that it is of one quality only; others, with Dufay, that it is of two kinds, which are called positive or vitreous, and negative or resinous. According to the former, it is imagined that bodies containing plus are always disposed to part with some to those containing

minus; and, according to the theory of the two fluids, bodies oppositely electrified attract, but those similarly electrified repel, each other.

Electricity passes rapidly from an electrified body to one which is not electrified; and of those which thus receive it, some, if held in the hand, will exhibit electrical excitement, others will not; those which exhibit this excitement are called bad conductors, the others conducting rapidly transmit the electric fluid so completely, that they have no remaining trace of it. The best conductors are the metals (almost in the same ratio as their conducting power of heat), plumbago, charcoal, water animals and plants, and most moist substances. The bad conductors are dry gases, glass, sulphur, resin, hair, silk, and wool, with many others.

Electricity is collected upon metallic substances by insulating them, that is, cutting off, by a non-conductor, their contact with the earth, which is the great absorber of electric fluid. For this purpose glass is used, covered with a coating of resin or shell-lac, either as a handle or stand to a prime conductor, or as feet to a stool.

The electricity collected by rubbing a piece of glass with cloth, appears to differ from that evolved by rubbing a piece of sealing-wax, on which account the terms vitreous and resinous electricity are used; for if two substances of the same kind be electrified from the glass, or from wax, they will repel each other; but if one be electrified from the wax it will be attracted to the other electrified from the glass. The terms negative and positive have superseded vitreous and resinous, as the quality of the electricity

depends more upon the rubber than on the glass or the resin.

A thread in a known electrical state is used as a test of the quality of the electricity in another body. The cat's back is said to be positive to all known substances, and glass stands next to it in order.

Sealing-wax is negative to most light subtances, but to the metals it is a positive electric.

All bodies contain electricity in a latent or quiescent state, that is, the two fluids are supposed to be in a state of neutralization. When electricity is evolved the balance is disturbed, or a separation of the fluids is supposed to take place. This separation is accomplished in various ways, as by friction, change of temperature, form, contact, chemical action, &c.

When two substances, if conductors and insulated, be rubbed together, each containing positive and negative electricity, it is supposed that the fluids are separated, and that all positive electricity collects in one and negative in the other. If, however, the substances thus rubbed be either both non-conductors, or one a non-conductor, the electric action is not manifested when they are kept in contact, and only when such bodies are separated.

A copious supply of electric fluids is obtained by the aid of the electrical machine, which consists of a cylinder or plate of glass, with a rubber, the latter made with leather stuffed with horsehair or wool, and coated with some amalgam. The cylinder or plate revolves on an axis, and is raised from the ground by wooden pillars, or a support;

a prime conductor is necessary, consisting of a smooth metallic cylinder, supported and insulated by means of a glass pedestal.

By causing the cylinder to revolve against the rubber, electricity is disengaged from the glass, the rubber and the amalgam: positive electricity is collected in the prime conductor, and negative electricity is accumulated in the rubber, or any insulated conductor in contact with it. To insure a succession of supplies it is necessary that either the rubber or the prime conductor should have communication with the earth.

Alteration of temperature in mineral substances is, in many cases, attended with manifestations of electrical excitement, but in no very remarkable degree.

Chemical action is a very abundant source of electricity, and to the latter perhaps we may attribute all chemical combinations. It is noticed that during combustion the burning body and parts surrounding are in oppositely electrified states, the burning body is negatively and surrounding bodies positively electrified. The electricity given off from the electrical machine is in a great measure owing to the chemical action, or oxidation, of the amalgam, for if metals be used not easily oxidized, very little electricity is disengaged. If an electrified body be made to approach an insulated non-electrified conductor, this latter becomes electrified, and, as it is said, by induction the surface nearest to the electrified body becomes dissimilarly, and that portion of the surface more remote, similarly electrified. Thus if a body positively electrified approaches another, it will cause

it to exhibit negative electricity opposite to it, and in consequence of this, the two attract each other. Clouds containing either positive or negative electricity, by coming near the earth, cause an accumulation of the opposite fluid on the earth's surface, and by their mutual attraction and combination produce lightning with its ravages.

A Leyden Jar consists of a glass bottle coated internally and externally within a few inches of its neck with tin-foil, or any other conductor. Insulate this jar and connect its internal coating with an electric source, supposed positive for the sake of illustration. The coating is now positively electrified by contact: in virtue of the law of induction the surface of the external coating nearest the glass becomes negatively, the other external surface positively electrified, as may be shown by approaching the finger, when for every spark passed into the jar we shall have a corresponding spark from the external coating: destroy this free positive electricity by connecting the coating with the earth, then we shall find that the external coating exerts no longer any electrical action, and the negative electricity above alluded to is said to be dissimilated by the positive of the internal coating; and keeping the outside coating in contact with the earth, and continuing to connect the inner coating with the source, the jar is, as it is said to be, charged. Now, if we connect the two coatings by means of a conductor, their electric state will instantly disappear with the evolution of light and heat, and a smart noise proportioned to the extent of the surface of the jar.

Many instruments have been invented to ascer-

tain the quantity and quality of the electric fluid in a body: they are named Electrometers and Electroscopes.

The electric and galvanic fluids are identical, although differing in their mode of separation and disengagement from bodies, in some of their effects, tension, &c. The intensity of the electric fluid is much greater than that from galvanism, as we see by its powerful attractive and repulsive qualities, and its tendency to force a passage through bodies. They are ordinarily applied in chemistry for opposite purposes. Electricity is used to promote combination, galvanism to decompose bodies; but Becquerel, by employing simple voltaic circuits of weak action, has been able to form many crystalline substances, which cannot be effected by ordinary chemical action. Thus, from carbonate lime, precipitated in the form of an amorphous powder, by ordinary chemical processes, he has, by the above means, obtained crystals of the carbonate, identical with those found in nature.

As in ordinary electricity there are two theories now in vogue, to explain the origin of this species of electric action, viz. that of contact proposed by Volta, and the chemical theory proposed by Fabroni, advocated by Wollaston, and now perhaps the prevailing one.

Galvanism took its origin from the convulsion produced in the leg of a frog in the neighbourhood of an electrifying machine in action. From what has preceded, it is evident that this was a case of induced electricity. Galvani established upon it a theory relative to the vital principle; Volta, however, took up the investigation,

and was led to the hypothesis that all bodies by their contact alone evolve electricity. Pursuing this idea, he took a plate of copper and of zinc, and putting them in contact, by delicate means, ascertained that they became oppositely electrified, the zinc positively, the copper negatively; he then (supposing the copper undermost) placed on the zinc a moistened piece of cloth, which, from the small electromotive action between liquids and solids, did not sensibly derange the former state. In virtue of conduction this moistened cloth becomes positively electrified with the zinc, and the zinc again takes from the copper the quantity of electric action necessary for the equilibrium; another couple of copper and zinc plates in the same order, *i. e.* with the copper undermost, was placed on the cloth: then the upper zinc, in virtue of its contact with the copper, also possesses a certain quantity of positive electricity, and in virtue of its connexion with the under pieces takes an equal quantity; thus the electric action of the upper zinc is double that of the first. By thus continually alternating with the moistened cloth and double plates placed in the same order, he formed the celebrated Voltaic Pile, in which theoretically the electric action of the uppermost zinc, in the comparison with the first, is proportionate to the number of couples of plates; the action of both the copper and zinc increasing from below to above. This supposes the lower copper in contact with the earth. If the pile be insulated, the electric actions decrease from the extreme plates to the middle. These extreme plates, or wires which are joined to them, are called the poles of the pile, or, as Mr. Faraday terms them,

electrodes. At the zinc pole, the positive electricity is manifest, at the copper, the negative.

By connecting these poles, the ordinary electrical phenomena are observable, as attraction, evolution of light, and of heat. By connecting the poles through various substances, the effects of the pile are manifested. With powerful instruments, the fusion of the most refractory substances is effected, volatilization of the metals, and all the phenomena of the electrical battery are produced. Interposing between the poles, water, chemical substances in solution, or more generally in a liquid state, their decomposition (if compound) is effected. Those substances which, in chemical combination, perform the function of an acid, appear at the positive pole; and those enjoying the properties of a base at the negative. So powerful is this effect, that ordinary chemical action appears suspended by voltaic influence. Thus, an acid in the above decompositions can pass through litmus without changing its colour. If, however, during its passage, an insoluble substance can be formed, precipitation will take place in spite of voltaic influence. Thus, if sulphuric acid, in its progress towards the positive pole, pass through nitrate of baryta, the insoluble sulphate will fall.

The galvanic trough or battery, so generally in use, acts on precisely the same principle: plates of zinc and copper are soldered together, or by conductors connected, and several of them in the same order are exposed together to the action of various fluids. Wires are attached to each end of the trough, the one touching the zinc, the other the copper plate. When these wires are brought

into contact, light is produced, and a shock may be given to the moistened fingers, much resembling that producible by the Leyden jar.

The electric and galvanic fluids possess the property of giving magnetic action to substances, and within the last three years, the intimate connexion between them has been established by very numerous experiments.

Water was the first substance decomposed by galvanism. This was accomplished by Sir Anthony Carlisle and Nicholson. Berzelius and Hisinger first observed the phenomena of transport, which Davy subsequently extended and generalized. On these facts, the modern electro-chemical theory greatly depends.

As all bodies have a certain electric relation; it is now customary to classify them under the heads electro-negatives and electro-positives. In these tables, however, it must be remembered, that if two of either class combine together, the one will be negative and the other positive. Thus oxygen and chlorine are both negative electrics, in respect to all bodies in the electro-positive column; but in relation to oxygen, chlorine is electro-positive.

ELECTRO-NEGATIVES.

Oxygen,	Tungsten,
Sulphur,	Boron,
Nitrogen,	Carbon,
Chlorine,	Antimony,
Iodine,	Tellurium,
Fluorine,	Columbium,
Phosphorus,	Titanium,
Selenium,	Silicon,
Arsenic,	Osmium,
Chromium,	Hydrogen.
Molybdenum,	

ELECTRO-POSITIVES.

Potassium,	Nickel,
Sodium,	Cobalt,
Lithium,	Cerium,
Barium,	Lead,
Strontium,	Tin,
Calcium,	Bismuth,
Magnesium,	Uranium,
Glucinium,	Copper,
Yttrium,	Silver,
Aluminium,	Mercury,
Zirconium,	Palladium,
Manganese,	Platinum,
Zinc,	Rhodium,
Cadmium,	Iridium,
Iron,	Gold.

ATOMIC THEORY.

In order to understand the Atomic Theory, the following axioms, or laws of chemical combination, should be recollected:

1. The composition of bodies is definite and invariable, both as regards the elements and their proportions. Thus, water is composed of 1 hydrogen and 8 oxygen by weight, and no other elements or proportions can form it.

2. Bodies combine in a few proportions only. Thus, zinc and oxygen combine in one proportion only; oxygen and hydrogen in two proportions; some bodies unite in three, four, or five proportions. We do not know the limit, but it seldom exceeds 5 proportions.

3. When one body, A, unites with another, B, in more than one proportion, the quantities of B are multiples by a simple whole number of the smallest quantity of B with which A can unite. Thus

Nitrous oxide is composed of	nitrogen 14, oxygen 8
Nitric oxide . .	nitrogen 14, oxygen 16
Hypo-nitrous acid . .	nitrogen 14, oxygen 24
Nitrous acid . .	nitrogen 14, oxygen 32
Nitric acid . . .	nitrogen 14, oxygen 40.

From this table, it will be easily seen that the quantities of oxygen contained in the four latter compounds are multiples of the quantity of oxygen contained in the first compound, viz. nitrous oxide. Thus, nitric oxide contains twice as much oxygen

as nitrous oxide; hypo-nitrous acid thrice as much; and so on.

A knowledge of these three laws will assist most materially in understanding the Atomic Theory.

Two opinions have divided philosophers respecting the nature of the ultimate elements of bodies, ever since they began to speculate on the subject. According to one party, these ultimate elements are infinitely divisible, every particle of matter, however small, being capable of still further division, if our instruments and organs were adapted for the operation. According to the other party, these ultimate elements consist of certain small particles incapable of further division, and to which the term atom is applied.

In order to avoid discussion, the term atom is used in chemistry to signify the ultimate particles of which any body is composed, without considering whether the further division of these particles be possible or not. The shape of the particles, their size, and their weight, are of course perfectly unknown.

But, although the weight of the atoms be unknown, yet we know that the atoms of different bodies differ from each other in weight. Thus, although we cannot say what the actual weight of an atom of oxygen or of an atom of hydrogen is, yet we can tell what the relative weights of these atoms are. We can tell that an atom of oxygen is eight times heavier than an atom of hydrogen. So also we can determine the relative weights of the atoms of almost all other bodies.

Now, whenever combination between bodies takes place, it is between their ultimate particles

or atoms. Thus, when oxygen and hydrogen combine to form water, the combination is between the particles or atoms of these elements, 1 atom of oxygen combining with 1 atom of hydrogen. An atom of one body may unite with 1, 2, 3, 4, or 5 (seldom more than this) atoms of another. Thus, in the foregoing table of the compounds of nitrogen and oxygen, it will be seen that nitrogen combines with 5 proportions of oxygen. In other words, 1 atom of nitrogen combines with 1, 2, 3, 4, 5 atoms of oxygen, forming five distinct compounds. It will be seen that 14 represents an atom of nitrogen, and 8 an atom of oxygen.

The mode of ascertaining the proportional or atomic number is as follows: a definite compound of two simple substances which have an extensive range of affinity, is to be carefully analyzed. Now oxygen and hydrogen have an extensive range of affinity for other bodies; hence a compound of these two is selected. There are two compounds of oxygen and hydrogen, water and the peroxide of hydrogen: water is selected because it contains the smallest proportion of oxygen and hydrogen. Water is regarded as a compound of one proportion or atom of oxygen, and one proportion or atom of hydrogen. But analysis proves that water is composed of 8 parts by weight oxygen, and 1 part hydrogen. Hence then it follows that an atom of oxygen must weigh eight times as much as an atom of hydrogen.

Some compounds are next examined which contain either oxygen or hydrogen in combination with some other substance, the quantities of each being the smallest that can unite together. Carbonic oxide is composed of 8 proportions of

oxygen and 6 carbon; sulphuretted hydrogen of 1 hydrogen and 16 sulphur. Hence the atomic or proportional number for carbon is 6, and for sulpher 16. The numbers of all other bodies may be determined in the same manner. From these observations then we come to the understanding, that atomic numbers represent the proportions in which bodies combine by weight.

This may be illustrated in the following manner. If we take 50 grains of chalk, and expose it to such a temperature that the carbonic acid is expelled, the 50 grains will lose 22 of their weight, which corresponds with the atomic number of carbonic acid.

A knowledge of these facts may become highly useful to the manufacturer, as he is thus enabled to mix, in exact proportions, the various substances intended to form certain compounds.

SIMPLE PONDERABLE SUBSTANCES.

The simple or elementary ponderable bodies are those which we are unable to reduce to other constituent parts. They are fifty-four in number, and may be classified in various ways. Some may be called combustible, others supporters of combustion; some are electro-negative, others electro-positive. But the most simple division is that into metallic and non-metallic bodies.

The non-metallic bodies are

Oxygen	Phosphorus	Fluorine
Hydrogen	Chlorine	Carbon
Nitrogen	Bromine	Boron
Sulphur	Iodine	Selenium.
		Silicon.

The metallic bodies are the following:

Potassium	Zinc	Titanium
Sodium	Tin	Bismuth
Lithium	Cadmium	Copper
Magnesium	Cobalt	Tellurium
Calcium	Nickel	Lead
Barium	Arsenic	Mercury
Strontium	Molybdenum	Silver
Aluminium	Chromium	Gold
Zirconium	Vanadium	Platinum
Glucinium	Tungsten	Palladium
Yttrium	Antimony	Rhodium
Thorinum	Uranium	Osmium
Manganese	Columbium	Iridium.
Iron	Cerium	

The simple elementary gases are four, namely, oxygen, hydrogen, nitrogen, and chlorine.

In speaking of the properties of gases, fluids, and solids, we generally mention that they have a certain specific gravity. By specific gravity is meant the relative weight of equal bulks of bodies. Atmospheric air is taken as the standard for gases, and water for liquids and solids. They are both taken as unity, or one thousand, although water is 815 times heavier than atmospheric air.

Gases are estimated by a specific gravity bottle, which will contain 1000 grains of atmospheric air; if this air be expelled, and another gas be introduced, and the bottle be then weighed, the difference will be perceptible. The same bulk of chlorine will weigh 2,470 grains, of oxygen, 1,102, of hydrogen, only 68 grains and a fraction.

The specific gravity of liquids is also ascertained by a proper bottle. Thus, suppose one to contain 1000 grains of water, and this water to be poured out and replaced by mercury, an equal bulk of the latter will weigh 13,545 grains. Thus we know that mercury is 13½ times heavier than water.

There is more difficulty with solids, especially if soluble or lighter than water. I shall limit myself to explain the mode of ascertaining the specific gravity of those which are insoluble and heavier than water.

If we take a piece of metal, and weigh it in a pair of scales, and ascertain its weight, we call this its absolute weight; it is then necessary to ascertain what an equal bulk of water would weigh. This is done by putting the metal into a vessel filled with water, in which case, water will be displaced equal to the bulk of the metal. This water must be weighed, and its weight be compared with that of the solid. If the metal weighed 100 grains, and the water 20, we understand that the metal is 5 times heavier than water; and as we agree upon calling water 1,000, the specific gravity of the metal will be 5,000.

There is another modification of this principle employed. If, after obtaining the absolute weight of the metal, it be suspended from the end of the beam of the scales by a fine thread, and be received in water, and again weighed, it will be found to have lost weight, which loss is exactly equal to the weight of the water displaced by the former preceding. Thus, instead of 100 grains, it will now only weigh 80 grains. The loss is to be taken as the divisor of the absolute weight, and the quotient will give the number of the times which the metal exceeds the water in weight.

OXYGEN.

Oxygen gas. *Properties:* devoid of colour, taste, and smell. Sp. gr. 1.1026: 100 cubic inches weigh

34.193 grains. It is a negative electric appearing at the positive pole; a non-conductor of electricity, the chief supporter of combustion; necessary for animal life. A lighted taper introduced into it burns with great brilliancy. The word oxygen is derived from οξυς, acid; and γενναω, I generate; having been supposed to be the sole acidifying principle. 100 cubic inches of water absorb about 3.5 grains. Equiv. 8.

It is procured from peroxides of metals, chlorate of potash, &c. It is most cheaply obtained by heating the peroxide of manganese in an iron vessel; in which case oxygen is evolved, and a deutoxide of manganese is left.

Peroxide of manganese with sulphuric acid produces a sulphate of the protoxide of manganese, and one atom of oxygen is evolved, being twice the quantity that we obtain by heat alone.

Chlorate of potash, heated in a glass vessel, is decomposed, and affords six atoms of oxygen, with chloride of potassium remaining in the retort.

Peroxide of mercury by heat will resolve itself into two equivalents of oxygen and metallic mercury. This process is too expensive. Nitrate of potash, heated carefully in a glass retort, will part with oxygen gas.

Oxygen, by combining with metals, forms numerous compounds, such as oxides, acids, alkalies, alkaline earths, and earths.

The union with bodies, assisted by heat, is often attended with the phenomenon called combustion.

Ordinary combustion may be defined, a rapid union of oxygen with a combustible body, attended with an evolution of light and heat.

HYDROGEN.

Hydrogen gas, known also as inflammable air, is the lightest body in nature, and exists in most animal and vegetable substances. Its name is derived from *υδωρ*, water; and *γενναω*, I generate. It is readily procured by decomposing water; either by passing its vapour in a tube over red hot iron filings, or from a mixture of sulphuric acid, water, and zinc, or iron filings. In these cases, water is decomposed, the oxygen combining with the metal, and the hydrogen is evolved. In the latter process it is often contaminated with some offensive oily matter, hydro-sulphuric acid, or carburetted hydrogen, from which, excepting the latter, it may be separated by passing it through a solution of potash.

Properties: devoid of colour, taste, and smell; sp. gr. .06896; a powerful refractor of light. 100 cubic inches weigh 2.1371 grains; does not support respiration, though not positively injurious to animal life: non-supporter of combustion, but combustible; when a mixture of two volumes of hydrogen and one of oxygen is ignited by a flame or electricity, violent explosion takes place, and water is formed. If either gas be in excess, water is still formed, and the superfluous gas remains. Equiv. 1.

The compounds of hydrogen with oxygen are two, viz. water and the peroxide of hydrogen.

WATER.

Composition:

	By weight.	volume.
Oxygen	8	1
Hydrogen . . .	1	2
Equiv. .9.		

Properties: a colourless transparent liquid, possessing neither taste nor smell; refractor of light: sp. gr. 1, taken as the standard of comparison for liquids and solids. 1 cubic inch weighs 252 grains; it is 815 times heavier than atmospheric air. The sp. gr. of watery vapour is .6202, that of ice .920. The purest water existing naturally is that from rain or melting snow; it is found, however, to have absorbed oxygen. The sparkling of water, ordinarily, is owing to the carbonic acid absorbed by it, which may be equal to its own volume under the ordinary pressure and temperature of the atmosphere. Bodies chemically combined with water are called hydrates.

Spring water frequently contains either the sulphate of lime, or carbonate of lime with excess of carbonic acid. It sometimes holds in solution, chloride of calcium or sodium. Spring water, commonly called *hard water*, is usually rendered turbid by soap, from the margaric and oleic acids, forming insoluble compounds with the lime.

Sea water contains a considerable quantity of saline matter, amounting on an average to 3 per cent. Sp. gr. from 1.026 to 1.028. Freezes at 28.5. The common ingredients are *Chloride of Sodium, Sulphate of Soda, Chloride of Magne-*

sium, and *Chloride of Calcium*, with a trace of potash, iodine, and bromine.

The *Peroxide of hydrogen*, or oxygenated water, is procured, by adding to water, peroxide of barium and hydrochloric acid, in successive quantities; subsequently, sulphuric acid and sulphate of silver; and lastly solid baryta, to remove all the sulphuric acid.

Properties: a colourless liquid; whitens and softens the skin; bleaches powerfully; is easily decomposed by heat, oxygen flying off with effervescence; should be kept surrounded by ice. Sp. gr. 1.452.

NITROGEN.

Nitrogen is one of the simple elementary gases, existing in greatest abundance in the atmosphere. It is also named azote, from α, privative, and $\zeta\omega\eta$, life, because it is not a supporter of respiration.

It may be most readily procured by burning phosphorus in a jar containing atmospheric air, or by the action of nitric acid on fresh muscle.

In the first process, the phosphorus combines with the oxygen, and forms pyrophosphoric acid, which is soon dissolved by the water, leaving in the jar nitrogen, with a little carbonic acid and vapour of the phosphorus. The gas is then to be passed through a solution of potash or lime, and the nitrogen emerges pure.

In the second process, by the action of the nitric acid on the muscle, nitrogen in considerable

quantity with a little carbonic acid, is evolved. The gas should be passed through lime water. The nitrogen is derived principally from the fibrine of the muscle.

Properties: devoid of colour, taste, and smell; neither a supporter of combustion, nor combustible; does not support respiration, but is only negatively injurious to animal life, killing animals by the exclusion of oxygen. Sp. gr. 972; 100 cubic inches weigh 30.166 grains. Equiv. 14.15.

The compounds of nitrogen with oxygen are five, and in the following proportions.

	oxygen.	nitrogen.
Nitrous oxide . . .	1	1
Nitric oxide . . .	2	1
Hyponitrous acid . .	3	1
Nitrous acid . . .	4	1
Nitric acid . . .	5	1

In addition to these, the atmosphere is composed of oxygen and nitrogen; but they appear to exist in it only in a state of admixture.

ATMOSPHERE.

Composition by volume: 79 or 80 of nitrogen and 20 or 21 of oxygen, that is, in the ratio of about 4 to 1; by weight, 28 of nitrogen and 8 of oxygen, with a very small proportion of carbonic acid, never exceeding 1.000th part. It is colourless; devoid of smell and taste; sp. gr. (taken as the stand of comparison for other gases,) is unity; it is 815 times lighter than water; 100 cubic inches weigh 31.0117 grains. Its

pressure on a square inch is equal to about 15lbs.; it can support a column of mercury of 30 inches, and one of water of 34 feet at the level of the sea. On the knowledge of this principle, barometers are constructed, and water is raised in pumps.

It is calculated to extend to about 45 miles above the level of the sea.

NITROUS OXIDE PROTOXIDE OF NITROGEN, 'OR LAUGHING GAS.

This gas is readily procured by decomposing nitrate of ammonia in a glass retort by heat. The hydrogen of the ammonia, uniting with 3 atoms of oxygen of the acid, forms 3 atoms of water; the remaining oxygen and nitrogen of the acid, with the nitrogen of the ammonia, form 2 atoms of the protoxide of nitrogen.

Properties: a colourless gas, with slight taste and odour; a powerful supporter of combustion; respirable for a few minutes, producing great excitement of the system, with a tendency to laughter. Water absorbs its own volume, and gives it out again when heated. It is best collected over warm water or mercury. Sp. gr. 1.5241. Equiv. 22.15.

BINOXIDE OF NITROGEN, NITRIC OXIDE, OR NITROUS GAS.

This gas is procured by the action of nitric acid on copper. Three equiv. of copper decompose 2 equiv. of nitric acid; 3 equiv. of peroxide of copper are formed, 2 equiv. of binoxide of nitrogen are set free. It may be collected over water or mercury.

Properties: colourless, tasteless, and inodorous; brought into contact with atmospheric air or free oxygen, it forms the red nitrous acid fumes. It is irrespirable, producing spasm of the glottis; a very feeble supporter of combustion. Charcoal and phosphorus immersed in it in a state of vivid combustion burn for a moment with increased brilliancy; it is sparingly absorbed by water. Sp. gr. 1.0377. Equiv. 30.15.

HYPONITROUS ACID.

This acid has only of late, been admitted as procurable in a free state. It is formed by keeping binoxide of nitrogen in a tube with a solution of potash over mercury for the space of two or three months. The binoxide of nitrogen is decomposed, and resolved into hyponitrous acid and protoxide of nitrogen, the former of which combines with the potash. It is also formed by mixing an excess

of binoxide of nitrogen with oxygen gas, kept over a strong solution of potash, and this over mercury. The acid produced combines with the potash. Dulong procured it by mixing the same gases, and exposing them to intense cold. Its existence was presumed from the fact that when an acid is added to the hyponitrite of potash, nitrous acid and nitric oxide are evolved. This acid forms with water and sulphuric acid a crystalline compound, such as is observed during the formation of sulphuric acid.

Properties: at zero it is a colourless liquid, but becomes green at ordinary temperatures; it is very volatile; by water it is decomposed and resolved into nitric acid and binoxide of nitrogen, which flies off with effervescence. It is of no particular use in chemistry or medicine.

Equiv. 38.15.

NITROUS ACID.

This acid may be procured by mixing binoxide of nitrogen with oxygen gas, or by heating the nitrate of lead, which has been carefully dried. The nitric acid is driven off in the form of nitrous acid and oxygen. Nitrous acid can exist either in a gaseous or liquid state, but for the latter, low temperature is required.

Properties of nitrous acid gas: orange red colour, pungent suffocating odour; irrespirable; readily absorbed by water, and resolved into nitric acid and binoxide of nitrogen, supports the combustion of ignited phosphorus, or even of a taper.

Properties of the liquid acid: yellowish orange colour at 60; yellow at 32; colourless at zero. Pungent odour; highly corrosive; strong acid taste; stains the skin yellow; is very volatile. Exposed to the air it passes rapidly into vapour. It parts with its oxygen readily to some metals.

During the admixture of small portions of water to this acid, remarkable changes of colour ensue, passing from colourless to blue, green, yellow, and orange. Equiv. 46.15.

NITRIC ACID.

This acid may be obtained by passing electric sparks through a mixture of oxygen and nitrogen with a little water over mercury, or by keeping the binoxide of nitrogen with oxygen over water. Water is necessary for the existence of nitric acid, for it cannot be procured in an insulated state. The ordinary nitric acid of commerce is obtained by pouring strong sulphuric acid upon the nitrate of potash; a bisulphate of potash is formed, and the nitric acid, with the water of the sulphuric acid passes over, and is condensed in a receiver. This acid, when pure, is colourless; but is commonly found combined with a small portion of nitrous acid, which gives it a yellowish red colour. If heat be applied the nitrous acid flies off, and nitric acid is left in a colourless state. The sp. gr. is 1.500; its equiv. is 54.15. Extensive use is made of it in chemistry to impart to metals their maximum of oxidation. Mixed with water,

heat is evolved. It may be decomposed by passing nitric oxide through it, which will form nitrous acid. It is also decomposed by the solar rays being resolved into nitrous acid and oxygen.

CARBON.

Carbon is a simple elementary non-metallic body, existing in its purest state in the form of the diamond; and in the next degree in plumbago, which contains on an average 97 per cent of carbon. A less pure form of it is the black opaque substance called charcoal. Charcoal may be procured from wood, coal, animal matter, oil of turpentine, and alcohol; the latter of which affords it in its purest artificial state. It is obtained by heating to redness these several substances in closed vessels, so as to prevent the oxygen of the air combining with the carbon, which would escape in the form of carbonic acid gas.

The charcoal from bones is called *ivory-black*, or *animal charcoal;* that from coal, *coke;* and that from resin, tar, and oils, *lamp-black.*

Properties of charcoal: bad conductor of heat; good conductor of electricity; absorbs gases, which it yields again when heated, and possesses this property most powerfully in the compact state. It also absorbs water; deprives bodies of their colour, taste, and smell; hence employed as a decolorizing agent, and to purify tainted flesh and water; combustible, affording by the combustion

carbonic acid; unites with oxygen in three proportions, forming carbonic oxide, oxalic acid, and carbonic acid.

The *Diamond* is the hardest body in nature; sp. gr. 3.520; it is a powerful refractor of light, and combustible. For its combustion it requires a very high temperature. Lavoisier effected the combustion of the diamond by concentrating upon it, the sun's rays with a powerful lens, in a jar of oxygen gas. The diamond disappeared, and carbonic acid was found to be produced equal in weight to the diamond and oxygen engaged.

Equiv. of carbon 6.12.

CARBONIC ACID.

Composition:

1 carbon	6.12	}	22.12.
2 oxygen	$2 \times 8 = 16$	}	

This gas may be readily procured from white marble, by pouring upon it dilute hydrochloric or sulphuric acid. The acid combines with the lime, and sets carbonic acid free.

Properties: colourless, insipid, and inodorous; sp. gr. 1.524; extinguishes flame; very destructive to animal life; when pure, it kills by occasioning spasm of the glottis; diluted, it acts as a narcotic poison; makes lime-water turbid by uniting with the lime; is absorbed by water in the proportion of equal volumes at the ordinary pressure of the atmosphere; if the pressure be increased, water can absorb several times its volume.

Carbonic acid is found in pits, and is then known as *choke-damp;* it is always evolved in lime-kilns; is found in malt-houses, brewers' vats, cellars, &c. Its presence in champagne, ale, porter, and even water, gives them most of their agreeable sharpness. The rapid escape of carbonic acid from fluids is the general cause of effervesence. It is given out from the lungs and skin by animals, as well as the other sources mentioned, and is, consequently, always found in the atmosphere. It combines with alkalies, forming carbonates; but has so weak an affinity, that it is displaced by nearly every other acid.

The escape of carbonic acid from the body may be shown by immersing any part of it in lime-water, when carbonate of lime will be deposited on the skin, and the water will be made turbid.

CARBONIC OXIDE GAS.

This gas may be produced by heating to redness in a gunbarrel, iron filings with twice the quantity of dried chalk; the carbonic acid, set free, is almost entirely decomposed by the iron, and carbonic oxide passes over. Any undecomposed carbonic acid may be separated by passing the gas through lime-water. It may also be obtained by passing a stream of carbonic acid over red-hot charcoal, or by decomposing the binoxalate of potash with sulphuric acid in a retort. By the application of heat carbonic acid and oxide are evolved.

Properties: it is devoid of colour, taste, and smell; combustible; extinguishes flame; a taper immersed in it is extinguished, but the gas burns on the surface with a bluish flame, and carbonic acid is the product. It is irrespirable, and if introduced into the lungs produces profound coma. It does not unite with lime or the pure alkalies, but passes through their solutions unchanged.

Composition: 1 carbon, 1 oxygen; equiv. 14.12; sp. gr. .972. It is almost always generated when vegetable substances are decomposed by heat in closed vessels.

SULPHUR.

Sulphur is a simple elementary body, existing in a solid state, chiefly procured in the neighbourhood of volcanoes, and found copiously combined with many of the metals, especially iron, copper, lead, and antimony.

Properties: a brittle solid of a yellow colour, and disagreeable odour when rubbed; a non-conductor of electricity. Sp. gr. 1.990; it fuses at 232°, passes rapidly into vapour between 572° and 600°; heated in the air to a temperature of about 300° it takes fire, and forms, with the oxygen, sulphurous acid gas. Equiv. 16.1.

Compounds of sulphur with oxygen:

	sulphur.	oxygen.	equiv.
Hyposulphurous acid . .	2	2	48.2
Sulphurous acid . . .	1	2	32.1
Hyposulphuric acid . .	2	5	72.2
Sulphuric acid . . .	1	3	40.1

SULPHUROUS ACID GAS.

Sulphurous acid in its pure state is a colourless gas, possessing a most suffocating odour. It may be obtained by burning sulphur in dry atmospheric air or oxygen gas, or, more conveniently, by heating copper or mercury and strong sulphuric acid together in a glass retort, and collecting the gas over mercury.

Rationale: a portion of the sulphuric acid is resolved into sulphurous acid and oxygen; the latter combines with the mercury, and, with undecomposed sulphuric acid, forms a sulphate of mercury, while the former passes over.

Properties: irrespirable, causing death by producing spasm of the glottis; extinguishes flame; water absorbs about 33 times its volume; it has very powerful bleaching properties; is easily liquified by compression; sp. gr. 2.2105. In combination with metallic oxides it forms the salts called sulphites. It has a great tendency to combine with more oxygen, so as to form sulphuric acid, but only when water is present, and it will take oxygen from substances which have not much affinity for it.

SULPHURIC ACID.

This acid may be procured from the sulphate of iron by the application of heat, in which case sul-

phurous acid, sulphuric acid, and oxygen are disengaged, and peroxide of iron is left in the retort. It is usually obtained in this country by the process described in the decompositions of the Pharmacopœia.

The acid obtained from sulphate of iron is called Nordhausen, from the place where it has been largely obtained. It is a dense liquid with a brownish colour; emits vapours when exposed to the air; sp. gr. 1.90. Is composed of two equiv: sulphuric acid and one of water. From this liquid, by careful distillation into a very cool receiver, crystallized anhydrous sulphuric acid may be obtained. This solid acid becomes liquid at about 66°, and by exposure to the air passes into vapour.

Properties of the common acid: a dense colourless liquid, of an oily consistence and appearance; boils at 620 degrees. Sp. gr., when most concentrated not exceeding 1.850; highly corrosive, destroying most animal and vegetable substances, occasioning a deposit of charcoal; has a very strong affinity for alkalies, and also for water, with which it unites in every proportion. If four parts by weight of this acid, and one of water be suddenly mixed together the temperature is raised to 300 degrees, arising from the condensation of the liquids. It absorbs watery vapour from the atmosphere, and is used, therefore, for hygrometrical purposes, and it may also be used for drying gases.

HYPOSULPHUROUS ACID.

This acid cannot exist for many minutes in an isolated state, speedily resolving itself into sulphurous acid and sulphur. It is formed by the action of sulphur upon a solution of a sulphite. The sulphur attracting an atom of oxygen from the sulphurous acid forms hyposulphurous acid, which combines with the base. It is obtained also by introducing sulphurous acid into a solution of the sulphuret of strontium or calcium.

Hyposulphites are mostly soluble in water, and possess a bitter taste.

HYPOSULPHURIC ACID.

This acid is formed by transmitting sulphurous acid gas through water containing binoxide of manganese; sulphuric and hyposulphuric acids are formed, both of which combine with the protoxide of manganese. Solution of pure baryta is then added, the protoxide of manganese is precipitated with sulphate of baryta, leaving the hyposulphate of baryta in solution; when to this sulphuric acid is added, an insoluble sulphate of baryta is precipitated, and the hyposulphuric acid is set free.

Properties: colourless; devoid of smell; combines with the alkalies, forming neutral salts;

unlike sulphuric acid, it forms soluble compounds with baryta, strontia, lime, and oxide of lead. By heat applied either to the acid or its salts, it is resolved into sulphurous and sulphuric acids.

PHOSPHORUS.

This substance may be procured from urine or from bones: when the former is employed, phosphoric acid is separated by acetate of lead; the phosphate of lead may then be decomposed by heating it with charcoal. It is generally procured at present from bones. The bones are first to be calcined, then heated with sulphuric acid, by which a comparatively insoluble sulphate of lime, and a very soluble superphosphate of lime, are formed. The superphosphate is taken up by warm water, which is then to be evaporated to the consistence of syrup. A third of its weight of charcoal is added to this, and heat is applied, when the charcoal, with the oxygen of the phosphoric acid, forms carbonic acid, while phosphorus passes over, and is collected in water in a receiver.

Properties: a transparent solid; sp. gr. 1.77; soft; of a waxy consistence and appearance when cut; generally of a light red colour; exposed to the air it burns slowly, with emission of light, which is visible in a dark place, and giving out at the same time a disagreeable alliaceous odour. It is very inflammable, burning rapidly when even gently rubbed, or by raising its temperature a little

above its point of fusion, which is 108 degrees Fahr. It passes rapidly into vapour at 550°. It burns most vividly in oxygen gas, with production of intense heat; is soluble in naphtha, fixed and volatile oils, and ether. It should be kept in water; placed in a jar of atmospheric air, it absorbs or unites with the oxygen, leaving the nitrogen free.

The compounds of phosphorus with oxygen are three, and, according to some chemists, four. They are oxide of phosphorus, hypophosphorous, phosphorous, and phosphoric acids. Equiv: 15.7; according to some chemists 31.4.

OXIDE OF PHOSPHORUS.

The oxide of phosphorus is obtained by bringing oxygen gas in contact with phosphorus while fused under water. Combustion takes place, and phosphoric acid and oxide of phosphorus are produced; the latter is in the form of little red globules.

It is without odour or taste, and is insoluble in water, alcohol, or oils. Permanent in the air. It is not applied to any chemical uses.

Composition:

phosphorus	oxygen.	equiv.
3	1	55.1

HYPOPHOSPHOROUS ACID.

This acid is obtained by acting on the phosphuret of barium with water. The water is decomposed, giving rise to the production of phosphuretted hydrogen, phosphoric, and hypophosphorous acid. The latter forms a soluble compound with baryta, which is then to be decomposed by sulphuric acid, so as to set free the hypophosphorous acid. This acid is particularly characterized by forming very soluble compounds with alkalies. Its most soluble and deliquescent salt is the hypophosphite of potash, which is even more deliquescent than chloride of calcium.

Composition:

phosphorus.	oxygen.	equiv.
2	1	39.4

PHOSPHOROUS ACID.

This acid is obtained by burning phosphorus in highly rarified air, or by decomposing the chloride of phosphorus in water. Hydrochloric and phosphorous acids are formed; the former is expelled by heat.

Properties: a white solid, soluble in water; disposed to attract oxygen and form phosphoric

acid; it has an alliaceous odour; by combining with alkalies it forms salts, named phosphites.

Composition:

phosphorus.	oxygen.	equiv.
2	3	55.4

PHOSPHORIC ACID.

Phosphoric acid is obtained from bones acted upon by sulphuric acid, or by burning phosphorus in a jar containing dry atmospheric air or oxygen gas. The white flakes which fall are pyro-phosphoric acid. This acid, by exposure to moisture, becomes phosphoric acid. It may also be obtained by the action of nitric acid on phosphorus, but most cheaply from bones. The bones are first to be calcined, then treated with sulphuric acid; the superphosphate is boiled with carbonate of ammonia. The soluble phosphate of ammonia is then heated, and the ammonia flies off. This leaves metaphosphoric acid, which, by the addition of water, is converted into phosphoric acid.

Properties: colourless; cannot exist without three atoms of water, combines readily with alkalies, forming sub-salts in the proportion of one of the acid to three of the base. It is distinguished from pyro and metaphosphoric acids, by forming a yellow precipitate with the nitrate of silver, having been previously neutralized by ammonia.

Composition:

oxygen.	phosphorus.	equiv.
5	2	71.4.

Pyrophosphoric and metaphosphoric acids contain the same elements as phosphoric, and in the same proportions, differing only in the effects produced upon other bodies.

BORON.

This is a simple elementary body, forming, with oxygen, boracic acid. It was discovered by Sir Humphry Davy, and was separated from oxygen by the galvanic battery. It is procured more readily by heating potassium with boracic acid, or by decomposing the borofluoride of potassium or sodium, by means of potassium.

Properties: a dark olive coloured solid, without taste or smell; not affected by water; heated to 600° in the air it inflames, and with the oxygen of the air forms boracic acid; it abstracts oxygen readily from all substances which contain a large quantity of it. Equiv. 10.9.

Boracic acid; the only compound of boron and oxygen may be obtained from borax by the action of sulphuric acid, which combines with the soda, setting free the boracic acid. This acid is obtained in a solid state; when dissolved in alcohol and ignited it gives a green colour to the flame. It has feeble acid properties, being displaced from bases by most other acids. It reddens turmeric paper like alkalies. Its most remarkable property is that of giving fusibility to the bodies with which it unites.

Composition:

1 boron	3 oxygen
equiv. 34.9.	

The crystallized acid contains 3 equiv. of water.

SELENIUM.

Selenium is a simple elementary body, found in combination with sulphur and several metals, particularly iron and lead. It has a leaden hue; but is red when powdered; is solid at ordinary temperatures; heated to 212 it softens, and boils at 630. Sp. gr. 4.300; insoluble in water; heated in the air it unites with oxygen, forming oxide of selenium and selenious acid, and gives out a very powerful odour resembling horseradish. Equiv. 39.6.

The compounds of selenium with oxygen are three:

	selenium.	oxygen.
Oxide of selenium . .	1	1
Selenious acid . . .	1	2
Selenic acid	1	3

The oxide of selenium, procured as above, is a colourless gas, and produces the horseradish odour when selenium is heated in the air.

Selenious acid is obtained by the action of nitric acid on selenium. It is a white solid; absorbs moisture from the air, and easily parts with its

oxygen to substances which have a strong affinity for it, being precipitated pure in the form of a red powder.

Selenic acid is obtained from seleniate of soda and nitrate of lead. The seleniate of lead which is thus formed is decomposed by sulphuretted hydrogen, and selenic acid is liberated, and remains in solution in water.

Properties: a heavy transparent colourless liquid, possessing a strong affinity for water, by combining with which, great heat is evolved, as by mixing water and sulphuric acid together. With hydrochloric acid it behaves like nitric by setting chlorine free, and forming a solvent for gold and platinum. In most of its combinations it very much resembles sulphuric acid, having a very strong affinity for earths and alkalies. Sp. gr. 2.60.

SILICON.

Silicon, the base of silica, is now classed amongst non-metallic bodies, as it wants some of the properties of metals. It was first obtained pure by Berzelius in 1824. It is most conveniently prepared by acting upon the double fluoride of silicon and potassium, or sodium, by potassium in a tube, with the assistance of heat; silicon is set free, and fluorine unites with the potassium.

Properties: a solid of a nut-brown colour, without metallic lustre; a non-conductor of electricity; not acted upon by the blow-pipe; is not

combustible either in oxygen or atmospheric air; not dissolved by the strong acids separately, but by a mixture of hydro-fluoric and nitric acids; mixed with carbonate of soda or potash, and heated, it burns actively; with oxygen it forms silicic acid, or silica. Equiv. 22.5.

Silicic acid, *Silica*, or siliceous earth, composed of one silica and three oxygen, is very abundant in nature. It forms flint, sand, quartz, chalcedony, onyx, agate, &c., and may be obtained from quartz sufficiently pure by making it red hot, throwing it into water, and subsequently pulverising it.

Properties: a white solid without taste or smell; fuses before the oxy-hydrogen blow-pipe; soluble in water only in its nascent state, when it forms a gelatinous bulky hydrate. Sp. gr. 2.69.

Silicic acid, although it has no acid re-action on test papers, behaves like an acid in combining with bases; with carbonate of soda or potash it displaces carbonic acid, and forms a silicate, which will be more or less soluble, according to the proportions; with soda and potash it forms glass, which differs with the nature of the alkali and foreign substances contained in it. Green glass contains some iron. Plate glass is free from impurities. In flint glass oxide of lead is introduced. The composition of common flint glass is said by Mr. Faraday to be in the proportion of about

4 silicic acid
1 potash
1 oxide of lead

Equiv. of silicic acid, 46.5.

CHLORINE.

Chlorine is one of the four simple elementary gases, but was for some time supposed to be a compound body.

It may be procured from hydro-chloric acid by adding to it binoxide of manganese, and applying a moderate heat. The gas passes over, and should be collected in glass vessels over warm water.

It may be obtained for ordinary purposes by a cheaper process, that is, by mixing three parts of sea salt with one of binoxide of manganese, two of sulphuric acid, and the same weight of water.

In the first process the hydro-chloric acid is decomposed; two equiv. of oxygen of the binoxide combine with the hydrogen of the hydro-chloric acid, forming water, chlorine is set free, and one equiv. of chloride of manganese remains.

In the second process the chloride of sodium is decomposed, and one equiv. of oxygen of the manganese combines with the sodium to form soda, setting free one equiv. of chlorine, and the sulphuric acid combines with the soda and protoxide of manganese.

Properties: It has a greenish colour; a strong smell and taste; is irrespirable; a supporter of combustion; some metals put into it in a finely divided state take fire, forming chlorides; cold water absorbs twice its volume, and yields it again when heated. It has bleaching properties, and is

considered to be a disinfecting agent; under a pressure of four atmospheres it may be condensed into a liquid of a yellow colour; electro-negative. Sp. gr. 2.47. 100 cubic inches weigh 76.599 grains. Equiv. 35.42.

Chlorine has a strong affinity for hydrogen, and on this probably depend its bleaching powers. Water is necessary for chlorine to bleach, and it is considered that the chlorine, by uniting with hydrogen, sets the oxygen free, which, by combining with the body, renders it colourless.

It is supposed to disinfect also by its affinity for hydrogen, decomposing fetid and injurious gases.

COMPOUNDS OF CHLORINE.

Chlorine unites with hydrogen in only one proportion, forming hydrochloric acid gas. This gas can be formed synthetically, that is, by passing electric sparks through a mixture of hydrogen and chlorine; but it is procured most readily by heating liquid hydrochloric acid.

Hydrochloric acid gas, is colourless; has a powerful odour and taste; is irrespirable; is not combustible; extinguishes all burning bodies; has an amazing affinity for water, which can absorb 480 times its volume. When the gas escapes into the air, it forms a white cloud by combining with the moisture; dissolved in water, it is known as liquid hydrochloric acid. Sp. gr. 1.2695.

Liquid hydrochloric acid should be colourless. It generally derives some colour from the presence of a little nitrous acid, chlorine, or iron; mixed

with nitric acid there is a mutual decomposition: the product known as aqua regia being a mixture of nitrous acid, water, and chlorine. The chlorine disengaged in this manner becomes a solvent of gold. Equiv. 36.42.

COMPOUNDS OF CHLORINE AND OXYGEN.

These compounds are four in number, and are as follows:

	chlorine.	oxygen.	equiv.
Hypochlorous acid .	1	1	43.42
Chlorous acid . . .	1	4	67.42
Chloric acid . . .	1	5	75.42
Perchloric acid . .	1	7	91.42

HYPOCHLOROUS ACID.

This acid now occupies the place of Euchlorine which is ascertained not to be a compound of 1 chlorine and 1 oxygen, but a mixture of chlorine with chlorous acid.

Hypochlorous acid is procured by introducing peroxide of mercury with twice its weight of water, into bottles filled with chlorine; both the oxygen and mercury combine with chlorine, forming bichloride of mercury and hypochlorous acid, which, being volatile, is separated from any peroxide and bichloride by careful distillation. This acid is considered to be formed when chlorine

is brought in contact with an alkali, as in the case of liquor sodæ chlorinatæ.

Properties: when dissolved in water it has a feeble yellow colour, and is transparent, with a strong odour, somewhat like chlorine; acts powerfully on the skin, like nitric acid; has strong bleaching qualities; exposed to a diffused daylight it gradually is decomposed and resolved into chlorine and chloric acid; it oxidizes many bodies very readily.

It has been procured by Balard, in the form of gas, and is then of a yellowish green colour; water rapidly absorbs 100 times its volume of this gas; it explodes by a moderate increase of its temperature.

CHLOROUS ACID.

This acid is procured by the action of sulphuric acid on the chlorate of potash; the sulphuric acid by uniting with the potash sets free chloric acid, which is resolved into chlorous acid and oxygen; the oxygen, instead of flying off, combines with undecomposed chlorate of potash, forming a perchlorate, which remains with bisulphate of potash.

Properties: a gas of rich green colour; very readily absorbed by water, to which it gives its tint; has bleaching properties. It explodes violently, when heated to 212 degrees; has acid qualities, and combines with bases forming chlorites, all soluble; by keeping, they are decomposed and resolved into metallic chlorides and chlorates. It was for some time named peroxide of chlorine.

CHLORIC ACID.

This compound is readily obtained by adding to the chlorate of baryta dilute sulphuric acid to saturation; an insoluble sulphate of baryta is precipitated, and chloric acid remains in solution.

Properties: reddens vegetable blues; does not bleach, combines with alkalies, forming chlorates; is readily decomposed by bodies having an affinity for oxygen. Its most remarkable combination is that with potash, formerly known as the oxymuriate of potash, which deflagrates like nitre when thrown on the fire; heated to redness in proper vessels it affords pure oxygen, the residual substance being chloride of potassium.

PERCHLORIC ACID

This acid is procured from the perchlorate of potash, one of the residual salts in the process for obtaining chlorous acid. Sulphuric acid is added to it, and, by combining with the potash sets free the perchloric acid, which by a heat of nearly 300 degrees, is distilled over in vapour, and condenses in a receiver as a colourless liquid. It is much less easily decomposed than the other compounds of oxygen; it may be boiled with sulphuric and hydrochloric acids without change. Its most insoluble compound is with potash, which requires 65 times its weight of water at ordinary temperatures for its solution.

QUADROCHLORIDE OF NITROGEN.

Chlorine unites with nitrogen in one proportion, forming a very explosive compound of an oily appearance. It explodes alone when heated to the boiling-point of water, and even at common temperatures in contact with combustibles, especially fixed and volatile oils. It is procured most conveniently by making a solution of hydrochlorate of ammonia with hot water, and at a temperature of about 90 degrees, inverting a bottle of chlorine over it. The chlorine is dissolved by the fluid, and decomposes the ammonia. In about half an hour yellow globules subside, which are the quadrochloride of nitrogen. Comp. 4 Equiv. Chlorine, 1 nitrogen.

Chlorine combines with carbon in two or three proportions, with sulphur, forming the chlorides of sulphur, and also with phosphorus, boron, silicon, &c.

IODINE.

Iodine is a simple elementary non-metallic body, existing in combination in sea-plants, many shells, &c. The name is derived from ιωδης, *violaceus*, in consequence of the colour of its vapour. It is procured most cheaply from kelp, in which it exists in the form of iodide of sodium and potassium, or from the fluid which remains

after the crystallization of the carbonate of soda. This liquid, sometimes named "mother-liquors, or soap-makers' lees," is to be treated with sulphuric acid and peroxide of manganese. In this process, an equivalent of oxygen of the manganese unites with the sodium or potassium; the iodine is set free, and a sulphate of manganese, with sulphate of soda, or potash, is left in the retort, the heat driving the iodine into the receiver, where it condenses.

Properties: solid at ordinary temperatures; has a metallic appearance; an odour like chlorine; a pungent taste; easily passes into a vapour of a violet colour; stains the skin of a deep reddish brown; is a non-conductor of electricity; a negative-electric: requires 7000 times its volume of water for solution; most soluble in ether and alcohol; has bleaching properties; forms a blue compound with starch which is insoluble in cold water; combines with metals forming iodides or iodurets; with hydrogen it forms hydriodic acid, with oxygen, iodic acid, and probably an oxide and iodous acid; up to the present these have not been clearly exhibited. Sp. gr. 4.948, Gay Lussac; sp. gr. of vapour, 8.716; equiv. 126.3.

Hydriodic acid may be obtained by passing the vapour of iodine and hydrogen through red-hot porcelain tubes; they unite, and form hydriodic acid; or it may be procured by the action of iodide of phosphorus on water. They are both decomposed. Hydriodic acid gas and phosphoric acid are the products.

Hydriodic acid gas reddens vegetable blues, smells like hydrochloric acid; forms white fumes

with atmospheric air; is readily absorbed by water; combines with alkalies forming hydriodates; easily decomposed by bodies which have a strong affinity for either of its elements, as chlorine, oxygen, &c. Equiv. 127.3.

Iodic acid may be obtained by the action of iodine on the euchlorine of Davy; the chlorine unites with some iodine to form a chloride of iodine; and the oxygen with iodine forms iodic acid. By heat the former passes off in vapour. It is a white solid; very soluble in water; has strong acid properties, and unites with numerous bases.

Composition:

Iodine	1
Oxygen	5

Equiv. 166.3.

Iodine forms compounds with chlorine, nitrogen, phosphorus, sulphur, carbon, and with most of the metals.

Periodic acid has recently been obtained by some German chemists, by acting upon iodate of soda with free soda and chlorine, in which case chloride of sodium is generated, and a periodate of soda of sparing solubility. By dissolving this in very dilute nitric acid, and adding nitrate of silver, exchange of acids takes place, and periodate of silver is formed. This requires to be dissolved, repeatedly, and heated, till it becomes an orange-coloured salt. When this is put into cold water it is decomposed, and resolved into free periodic acid in solution, and a sub-periodate of silver. It has powerful acid properties, is

permanent in the air, and is affected by other bodies in a very similar manner to perchloric acid.

Composition:

1 Iodine, 7 Oxygen, } Equiv. 182.3.

BROMINE.

This substance closely resembles iodine in its properties. It exists in sea-water and marine plants, in the form of bromide of magnesium and sodium. It is procured from bittern, the residual liquid after crystallizing the chloride of sodium and sulphate of magnesia, by passing chlorine through it. The chlorine unites with the magnesium or sodium, and bromine is set free. It may be taken up by ether, or distilled over into a cool receiver.

Properties: a very dark liquid at the ordinary temperature, of an offensive odour, solid and brittle a little below Zero. Sp. gr. 3; negative-electric; very destructive to animal life; vaporises readily, and requires to be kept under water; soluble in alcohol and ether, most so in the latter; a supporter of combustion; antimony and tin take fire in it, but potassium burns most vividly. Like Iodine it forms acids with hydrogen and oxygen, and compounds with the simple combustibles, metals, &c. Equiv. 78.4.

FLUORINE.

Fluorine has, within a very short period only, been obtained in an isolated state, and even now has not been separated from admixture with some of its compounds. It is described as being procured by the action of sulphuric acid and binoxide of manganese on the fluoride of calcium. It is found to be a gas of a yellowish brown colour, with an odour like burnt sugar with chlorine, to which it bears analogy also in many of its properties. It bleaches, unites with gold directly, has a strong affinity for hydrogen and metals, and is a negative electric. Sp. gr. 1.289. Equiv. 18.68.

Its most simple compound is that with hydrogen, forming hydro-fluoric acid.

Hydrofluoric acid is obtained from fluor spar acted upon by sulphuric acid. Fluor spar is presumed to be a fluoride of calcium. The water of the sulphuric acid is decomposed, its oxygen combines with the calcium, forming lime, which, with the sulphuric acid, makes sulphate of lime; the hydrogen combines with the fluorine, and passes over into a receiver, where it is condensed.

Properties: it is a colourless liquid, at 32°, and may be kept so as high as about 60° in closed vessels; if exposed, it passes into vapour: it is the most corrosive body known; very deleterious to animal life; has the power of dissolving glass; hence must be kept in metallic vessels; with the glass it forms fluosilicic acid. It has an amazing

attraction for water, more so than even sulphuric acid; when combining, they give out a hissing noise, like when a hot iron is put into water.

It forms, with boron fluoboric acid, and fluosilicic acid with silicon, which are highly interesting compounds.

AMMONIA.

Ammonia, commonly known as the volatile alkali, is a compound of 3 equiv. of hydrogen and 1 of nitrogen.

Its purest state is that of gas; dissolved in water, which can absorb 780 times its volume, it forms liquor ammoniæ.

Ammoniacal gas can be readily obtained by heating liquor ammoniæ.

Properties: colourless; has a pungent odour; brought into contact with hydrochloric acid gas, it forms a dense cloud of hydrochlorate of ammonia; irrespirable in its pure form; it extinguishes flame, but is slightly combustible; is generally generated by decomposition of animal matter by heat. The constituent gases of ammonia cannot be made to unite synthetically. Sp. gr. of ammoniacal gas .5898, equiv. 17.

COMPOUNDS OF CARBON AND HYDROGEN.

The compounds of carbon and hydrogen are numerous. Those longest known are light car-

buretted hydrogen, and olefiant gas; to these a long list may be added, for which the reader is referred to comprehensive chemical works.

Light carburetted hydrogen may be obtained by stirring up the mud of stagnant pools, and collecting it in glass vessels. It is generated copiously in coal-mines, and is there known as firedamp; for, when mixed with oxygen or atmospheric air, and a flame is brought in contact, violent explosion takes place. It is irrespirable when pure, extinguishes a lighted taper put into it, but is combustible, the products being carbonic acid and water. Sp. gr. .5594. Its proper name is the dicarburet of hydrogen, its popular names are firedamp, heavy inflammable air, and inflammable air of marshes.

Composition:

Carbon	. .	1
Hydrogen	. .	2

Equiv. 8.12.

Sir H. Davy's lamp, used by miners to prevent explosion from firedamp, acts by the wire-gauze being a good conductor of heat, carrying off from the flame which approaches it, so much of its heat, that it is disabled from igniting gases on the outside. But as currents of air sometimes will drive the flame through the wire-gauze, and explode the gas outside, this lamp is not perfectly safe. To remedy this, an improvement has been made of late years, viz., that of surrounding the wire-gauze with glass, excepting at the top and bottom, which is closed by wire-gauze exceedingly fine. This improvement has saved the lives of many persons.

Olefiant gas is obtained from alcohol by acting on it with sulphuric acid ; its name is derived from its forming an oil-like fluid with chlorine. Sp. gr. .972.

Composition :

Carbon . .	2
Hydrogen . .	2

Equiv. 14.24.

HYDROSULPHURIC ACID, OR SULPHURETTED HYDROGEN.

This gas is obtained by pouring diluted sulphuric acid on sesquisulphuret of antimony, or protosulphuret of iron ; water is decomposed ; the oxygen goes to the metal, which combines with the acid, and the hydrogen with the sulphur escapes in the gaseous form. It is also given out very copiously when hydrochloric acid and sesquisulphuret of antimony are employed. Double decomposition takes place, and the products are sesquichloride of antimony, and hydrosulphuric acid gas.

Properties: colourless: of a very offensive odour, resembling rotten eggs ; irrespirable, and very destructive to animal life ; has acid properties ; reddens litmus paper ; combines with alkalies, forming hydrosulphates ; has a strong affinity for metals, tarnishing silver and gold, and is readily known by its powerful effects in blackening the salts of lead. Sp. gr. 1.177.

Composition :

Sulphur . . .	1
Hydrogen . .	1

Equiv. 17.1.

Sulphur combines with hydrogen in another proportion to form persulphuret of hydrogen. It is procured by boiling sulphur, lime, and water, together. The liquid formed by these is poured into slightly diluted muriatic acid, and a yellow oily fluid subsides, which is the persulphuret of hydrogen.

Properties: is decomposed very readily by almost all substances, resolving itself into sulphur and hydrosulphuric acid; it has the odour of the latter but more feeble. Sp. gr. 1.769. It has no acid reaction on test papers, and it is very questionable whether it should be called an acid. If it should be so designated, its name is hydro-persulphuric acid.

Composition:

Sulphur . . .	2
Hydrogen . .	1

Equiv. 33.2.

CYANOGEN.

Cyanogen is a gas composed of carbon and nitrogen, in the proportion of two equivalents of the former and one of the latter. It is obtained from the bicyanuret of mercury by the application of heat.

Properties: colourless; has a strong pungent odour; extinguishes burning bodies, but is combustible, burning with a purple flame; is absorbed by water and alcohol; unites with most elementary substances; the compounds are called cyanides or cyanurets. Equiv. 26.39.

Towards the end of the process for separating the cyanogen from mercury, a brownish substance is deposited in the retort. This, upon careful examination, is found to contain the same elements as cyanogen, and is isomeric with it, although differing widely in its physical qualities. It is named *Paracyanogen.* Johnston, who detected this, suggests that the carbonaceous matter left after the slow combustion of vegetable substances, may consist, in a great degree, of paracyanogen. Other compounds of nitrogen and carbon are mentioned by chemists, for which the curious and enquiring chemical student is referred to the more extensive works.

HYDROCYANIC ACID.

This acid is obtained by mixing together hydrochloric acid and bicyanuret of mercury in a retort; mutual decomposition takes place, hydro-cyanic acid is formed and rises, and bichloride of mercury is left. If it is desirable to obtain the acid as free as possible from water, it is passed over chloride of calcium, and through fragments of lime, to remove any undecomposed hydrochloric acid.

Another plan adopted, is to pass hydrosulphuric acid through a tube containing bicyanide of mercury. The sulphur combines with the mercury and the hydrogen with the cyanogen.

Pure *prussic acid* is a light volatile fluid, possessing a powerful odour, like peach blossoms. It

boils at 80° ; unites with water and alcohol in any proportion; is easily decomposed, and more rapidly so if exposed to light, a brownish black substance, like charcoal being deposited, and ammonia is found in the liquid. It has weak acid properties, for it is even separated from its bases by carbonic acid.

Composition:

1 Cyanogen
1 Hydrogen
Equiv. 27.39.

For the ample details respecting the *Ferrocyanurets*, consult Dr. Turner's or Brande's Chemistry.

METALS.

The metals are 41 in number, and are elementary bodies. They are generally heavy, opaque, good conductors of heat and electricity; have a metallic lustre; some of them are very malleable and ductile. They are mostly positive electrics, and appear at the negative pole.

They differ in the products when combined with oxygen: thus, by combining with oxygen, they form oxides, acids, alkalies, alkaline earths, and earths. The metallic bases of the alkalies are three, potassium, sodium, and lithium.

The metals which form alkaline earths with oxygen are: magnesium, calcium, barium, and strontium.

The metallic bases of the earths are: aluminium, thorinum, zirconium, glucinium, yttrium.

The metals which, with oxygen, form acids are: antimony, arsenicum, manganese, chromium, vanadium, molybdenum, columbium, tungsten, titanium, and tellurium.

The metals principally employed in medicine are: mercury, antimony, iron, zinc, copper, silver, bismuth, arsenic, and lead.

Potassium may be obtained by heating to whiteness fused potash with iron filings in a gunbarrel. At this temperature the iron filings acquire the greatest affinity for oxygen and attract it, potassium flies off in a state of vapour, and is condensed in a cool receiver. Some chemists employ carbonate of potash, iron filings, and charcoal, which is a less expensive process; but the potassium obtained is not quite so pure.

Properties: solid at ordinary temperatures; quite liquid at 150°; brittle when cooled to 32°; lustre somewhat silvery; sp. gr. .865; a good conductor of heat and electricity. Thrown into water, on which it floats, the water is decomposed, oxygen unites with the metal, and hydrogen is liberated, and takes fire with a portion of potassium. The combustion is either caused by the heat evolved in consequence of the oxygen combining with the potassium, or from the potassuretted hydrogen being so inflammable as to take fire in contact with the atmosphere. This metal must be kept from contact with oxygen, as in naphtha, or in a bottle hermetically sealed. Equiv. 39.5.

Potassium combines with oxygen in two proportions, forming potash and the peroxide of potas-

sium. The latter is soon decomposed after its formation, being resolved into protoxide and oxygen.

Sodium may be procured from soda by a process similar to that for obtaining potassium. It has a considerable resemblance to potassium, but is rather heavier; sp. gr. .972. Its action upon water is very powerful, but there is no flame produced. If gum, however, be added to the water, light is frequently emitted. This metal unites with oxygen in two proportions, forming soda and peroxide of sodium. Equiv. 23.3.

Lithium, the metallic base of Lithia, was first separated from oxygen by Sir H. Davy. It has a powerful affinity for oxygen, which is an obstacle to the ready examination of its qualities. Its equiv. is 6. It unites with oxygen in only one proportion.

Lithia exists in the minerals named petalite, spodumene, lepidolite, and lithion mica. Its properties are closely allied to those of soda and potash. Its neutralizing power is greater, and it forms less soluble compounds with phosphoric and carbonic acids. Its salts yield a red colour to flame, on a platinum wire before the blowpipe,

Barium is the base of baryta; the salts of this metal are exceedingly heavy, and have obtained their name from that circumstance. Baryta is usually found in combination with carbonic and sulphuric acids, for which it has a strong affinity. The soluble salts of baryta are very poisonous. There are two oxides of this metal. Equiv. 68.7.

Strontium, is the basis of strontia, which very closely resembles baryta. It exists naturally as a

carbonate and sulphate: the latter is often accompanied by free sulphur. Its salts are very heavy, and give a red colour to flame: there are two oxides of this metal. Equiv. 43.8.

Calcium, the metallic base of lime, unites with oxygen in two proportions, forming common hydrated protoxide of lime, also known as unslaked lime, and peroxide of calcium. Equiv. 28.5. Lime has very similar affinities to baryta and strontia, but forms a more soluble compound with sulphuric acid. The most insoluble salt is formed by uniting it with oxalic acid. Another curious fact is, that lime is more soluble in cold than in hot water. Lime exists most abundantly in the form of carbonate and sulphate.

The sulphate requires about 500 times its volume of water for solution.

The carbonate forms marble, lime-stone, and chalk.

The sulphate exists in the state of gypsum, alabaster and, artificially prepared, constitutes plaster of Paris.

Magnesium was discovered by Sir H. Davy, by means of galvanism, and has since been prepared more largely by the action of potassium upon the chloride of magnesium. This metal is at present known only to combine with oxygen in one proportion. Equiv. 12.7. Magnesia exists naturally combined with carbonic acid, as a hydrate of magnesia, and in sea-water with chlorine and sulphuric acid. It is distinguished from the other alkaline earths, by forming a soluble compound with sulphuric acid.

Aluminium is the metallic base of alumina, which is the chief proximate principle of most clays. It

is therefore a constituent of various kinds of pottery, in combination with a small portion of water. The ruby and sapphire are almost entirely composed of alumina. Equiv. 13.7.

Glucinum is found oxidized in the beryl, euclase, and emerald. Equiv. 26.5.

Yttrium exists in the mineral called Yttria, found at Ytterby in Sweden. Equiv. 32.2.

Thorinum is the metallic base of the mineral called thorite. Equiv. about 67.6.

Zirconium is found in the Jargon or Zircon of Ceylon, and in the Hyacinth. Equiv. 33.7.

Manganese is always found oxidized, from its strong affinity for oxygen. Its compounds with oxygen were stated to be three, but now are said to amount to no less than seven. They are the protoxide, sesquioxide, peroxide, red oxide, varvacite, manganic and permanganic acids. The protoxide is of a green colour, and enters into most of the salts of manganese, the sesquioxide is brownish, and the peroxide black. Manganic acid, with potash, forms that singular substance named chameleon mineral, which affords a variety of colours by its solution in water. Equiv. 27.7.

Iron is a very hard tenacious metal; it requires more heat in melting than gold or silver: is capable of being welded; is attracted by the magnet, may be rendered magnetic, which property belongs only to this metal, nickel, and cobalt. Iron exists naturally combined with oxygen or sulphur, forming iron pyrites, red and black oxide of iron; in other forms it is found more sparingly. The oxygen is removed from the ore by charcoal and heat, or more rapidly by passing hydrogen gas over it in a porcelain tube. Equiv. 28.

The oxides of iron are two, and according to some chemists three: the protoxide is doubtful as to its colour: it exists in the sulphate of iron, which throws down a white precipitate when pure potash is added. The peroxide or sesquioxide, is of a red-brown colour, existing naturally as hæmatite iron. The black oxide is supposed to be a mixture of protoxide with peroxide. Iron unites with sulphur in several proportions. The compounds are the tetrasulphuret, disulphuret, protosulphuret, sesquisulphuret, and bisulphuret: the last of which is the common iron pyrites of mineralogists. There are three compounds of iron with carbon, viz. plumbago, cast iron, and steel. In the first, a natural product, the iron amounts to from 5 to 10 per cent., in cast iron the carbon amounts to from 3 to 5, and in steel from 1.25 to 1.75 per cent. The rust on iron railings is usually a mixture of peroxide of iron, carbonate of iron, and ammonia.

Zinc is found naturally as a carbonate named calamine, or sulphuret, named blende. This metal is commonly called spelter. It is sublimed at a white heat, and, if in contact with the air, attracts oxygen, and forms with it, if received on a plate placed over it, the well known philosopher's wool. The oxides of zinc are supposed to be two, the protoxide and peroxide. Zinc melts at about 700. Equiv. 32.3.

Cadmium exists only in sparing quantities, and is found principally in the ores of zinc. In its pure state it resembles tin, but is harder and more tenacious. It is easily distinguished from tin, by its ready volatility. Equiv. 55.8. There is only one known oxide. The sulphuret of

cadmium, obtained by passing hydro-sulphuret through a solution of the salts of cadmium, has a yellowish-orange colour, which might be mistaken for arsenic. It is distinguished readily from sulphuret of arsenicum, by being insoluble in pure potash.

Tin exists naturally in combination with oxygen, and is most abundant in Cornwall. The metal is obtained from it in the forms of block and grain tin. The oxides of tin are the protoxide, sesquioxide, and peroxide. Tin melts at 442°. This metal, with lead, forms *solder*, and with antimony *copper;* with bismuth, the best *pewter*. Equiv. 57.9.

Cobalt is found associated with arsenic, forming arsenical cobalt. The arsenic is removable by heat, and oxide of cobalt or zaffre remains. This, heated with sand and potash, produces smalt. The chloride of cobalt is used under the name of sympathetic ink. Combined with water it is almost colourless, but deprived of it, turns blue, and green if a little iron or nickel be present. Equiv. 29.5.

Nickel, is not a very abundant metal; it is a constituent of meteoric iron, and is found associated with copper, arsenic, cobalt, iron, and sulphur. It has, when pure, a white colour, nearly resembling silver; combines with oxygen in two proportions. Equiv. 29.5. Most of the salts of nickel are of a green colour.

Arsenic is found native, but most commonly with cobalt and iron, occasionally with sulphur forming the yellow arsenic, or orpiment, and realgar. It is particularly known by its volatility, and the phosphuretted or alliaceous odour which it gives out when heated. Equiv. 37.7. It com-

bines with oxygen in two proportions, forming arsenious and arsenic acids. The sulphurets of arsenicum are three, the protosulphuret is red, and is named realgar; the sesquisulphuret, or orpiment, is yellow; and the persulphuret is yellow also. They are all poisonous.

Chromium exists naturally in the form of dichromate of lead, and chromate of iron, in which oxide of chromium is mixed with oxide of iron. From this ore it is usually obtained. Equiv. 28. It unites with oxygen in two proportions, forming oxide of chromium and chromic acid. The latter is interesting, from forming a very good test of the presence of lead, forming with it a yellow insoluble precipitate.

Vanadium exists in an iron ore of Sweden, and in the vanadiate of lead, which is found in Scotland; with oxygen it forms a protoxide, binoxide, and vanadic acid. Equiv. 68.5.

Molybdenum is found mostly as a sulphuret, resembling plumbago, also as a molybdate of lead; with oxygen, it forms two oxides and an acid. Equiv. 47.7.

Tungsten occurs as a tungstate of iron, manganese, or lime. In its pure state it is very heavy, and almost as hard as steel; with oxygen it forms a sesquioxide, binoxide, and tungstic acid. Equiv. 99.7.

Columbium, discovered as recently as 1801, is met with in minerals, named Tantalite and Yttrotantalite. It forms, with oxygen, an oxide and columbic acid. Equiv. 185.

Antimony is found plentifully combined with sulphur, most frequently in acicular crystals. It unites with oxygen in three proportions, forming

sesquioxide, antimonious and antimonic acids. Equiv. 64.6.

Uranium is found in the mineral named pitch-blende, and the beautiful substance named uranite. It forms two compounds with oxygen, viz. the protoxide and peroxide, which are much used as colours in the manufacture of porcelain. Equiv. 217.

Cerium exists in cerite and allanite. It has two degrees of oxidation. It is of no particular service in the arts. Equiv. 46.

Bismuth is found native or combined with sulphur, arsenic, and oxygen. It unites with oxygen in two proportions. The nitrate of bismuth is distinguished from other nitrates by water decomposing it, throwing down trisnitrate of bismuth. Equiv. 71.

Titanium is met with, combined with iron, in the mineral called titanite, octahedrite, or anatase, and rutile; with oxygen it forms an oxide and an acid. Equiv. 24.3.

Tellurium, found associated with gold and silver; with oxygen forms two compounds, tellurous and telluric acid. Equiv. 64.2.

Copper is found native, but most abundantly oxidized or combined with sulphur, under the name of copper pyrites. There are three oxides of copper, according to the latest chemical researches. The dioxide or red oxide, the black or protoxide, and the superoxide. Copper beaten into leaves takes fire when immersed in chlorine. It is frequently alloyed with other metals: with zinc, it forms *brass*, *tombac*, and *pinchbeck;* with tin, *gunmetal*, *bronze*, and *bellmetal;* it is also alloyed with gold and silver in the coin of this

realm. Equiv. 31.6. The salts of copper contain the black oxide.

Lead is a very abundant natural product, most commonly found in combination with sulphur, under the name of galena. It is from this ore that nearly all the lead of commerce is obtained. The distinct oxides of lead now described, are three, and there is another, viz.. the red oxide, which appears to be a mixture of protoxide with peroxide. These are the dinoxide, protoxide, peroxide, and red oxide. The dinoxide is dark gray, nearly black; protoxide is yellow, and is known by the names of massicot, and mixed with a little red lead forms litharge. It enters into the acetate of lead. The peroxide of lead is of a puce colour. Lead, alloyed with antimony, is used for printer's types. Equiv. 103.6.

Mercury is seldom found uncombined; it is obtained from cinnabar, a sulphuret of this metal, by heating it with lime, when the products are sulphuret of calcium, sulphate of lime, and metallic mercury. It is the only metal which is fluid at ordinary temperatures. Its freezing point is about 40° below zero; its boiling point 662°, but according to some 680°. It unites with oxygen in two proportions, forming the black protoxide and red peroxide; with tin it forms an amalgam for looking-glasses, and is used with gold in the process of gilding. Equiv. 202.

Silver is found native and combined with some other metals. It is most commonly extracted from the sulphuret, and the ores of lead with silver, by amalgamation and cupellation. It is the whitest of the metals, very soft, malleable, and ductile; it unites with oxygen only in one pro-

portion. This oxide has a brownish black colour. Equiv. 108.

Gold is always found in the metallic state, but sometimes associated with other metals. It is remarkable for its insolubility in pure acids. It is the most ductile and malleable of metals. It is presumed to combine with oxygen in three proportions forming the protoxide, binoxide, and peroxide. Equiv. 199.2.

Platinum, like gold, is only known to exist in the metallic form. It is found in Peru and the Uralian mountains, often associated with other metals. It is the heaviest of metals, bears the strongest heat of the forge without fusion, and is not acted upon by any pure acid. It is supposed to combine with oxygen in three proportions, forming the protoxide, sesquioxide, and binoxide.

Palladium, *Rhodium*, *Iridium*, and *Osmium* are always found in company with platinum. They exist only in minute quantity, and are of no great interest to the medical man.

ORGANIC CHEMISTRY.

ANIMAL and vegetable bodies are very complicated in their structure, and are formed by a series of compounds, named proximate principles, which can be resolved into a small number of simple elements. These elements are four, viz. oxygen, hydrogen, carbon, and nitrogen.

Organic bodies are very liable to undergo decomposition, when deprived of vitality and exposed to moisture and air. Vegetable substances are formed almost entirely of oxygen, hydrogen, and carbon; nitrogen is sometimes present, but in small quantity: so that when decomposed by natural changes they afford carbonic oxide, carbonic acid, water, carburetted hydrogen, and in a few instances ammonia.

Organic bodies are distinguished also by the difficulty, and indeed impossibility, of imitating them by chemical art; and likewise by their undergoing complete decomposition when exposed to red heat.

Vegetables contain numerous compounds, called proximate principles, such as resin, gum, &c. Many of these proximate principles, again, may be combined in a juice of the plant, as in opium,

and may exist in one particular portion, or diffused through the plant generally. The numerous proximate principles are found to contain the same elements, but in various proportions. The process adopted to ascertain the proportion of elementary particles is called ultimate analysis. To effect this, a quantity of vegetable is put into a vessel with a certain quantity of peroxide of copper, and a sufficient heat is applied to ignite the vegetable substance. The relative quantity of carbon, oxygen, hydrogen, or nitrogen, is deduced from the products. This is one of the most difficult processes in chemical manipulations.

Vegetable substances admit of a classification, according to the relative quantity of oxygen and hydrogen contained in them. If the oxygen to the hydrogen exists in a greater quantity than is sufficient to form water, the substance is generally acid; if the hydrogen predominates over the oxygen, the substance is oily or resinous; if they exist in the proportions to form water, the substance is not acid, oily, or resinous, but forms sugar, gum, starch, &c.

The vegetable acids contain oxygen, hydrogen, and carbon, excepting only oxalic acid. Many of these exist in plants ready formed; some are products of the fermentative, or other changes.

Acetic acid is found in plants ready formed, in combination with lime or potash, but is commonly produced by acetous fermentation; it is also procured by the destructive distillation of vegetable matter.

This acid combines with numerous bases, form-

ing acetates, which are soluble either in cold or hot water.

Composition of the acid, according to Prout,

3 hydrogen
3 oxygen
4 carbon

Oxalic acid is found in the oxalis acetosella, rumex acetosa, rhubarb, tendrils of the grape, &c.

For commercial purposes it is prepared artificially, by the action of nitric acid on sugar. The nitric acid appears to abstract all the hydrogen and part of the carbon from the sugar, leaving the elements of the sugar in the proportions to form oxalic acid, which is equal in weight to half the sugar employed. This acid is also generated by the action of nitric acid upon many other organic substances, as gum, starch, wool, silk, &c. The crystallized acid contains three equiv. of water.

Composition:

3 oxygen.
2 carbon.

or it may be considered as a compound of carbonic acid and carbonic oxide. By some chemists it is designated, a carbonate of the protoxide of carbon. Some of the salts of oxalic acid are insoluble, others of very sparing solubility in water.

Tartaric acid exists in the grape-juice, and is readily obtained from the tartar of wine-casks after it is purified, by the process recommended in the London Pharmacopœia. This acid is

distinguished by its great affinity for potash, which it abstracts from every other acid, and by its disposition to form double salts.

Composition of crystallized tartaric acid:

2 hydrogen.
5 oxygen.
4 carbon.
1 water.

Citric acid is obtained in greatest purity and quantity from the juice of the lime and lemon, by the process ordered in the Pharmacopœia. Dissolved in water it is liable to be decomposed by keeping. Its salts are called citrates, amongst which the citrate of lime is very insoluble, that of potash is very soluble.

Composition:

2 hydrogen.
4 oxygen.
4 carbon.
2 water.

Malic acid is found in many acid fruits, in combination with citric and tartaric acid, as in tamarinds. It is contained in apples, and almost uncombined in the fruit of the Sorbus aucuparia, the wild service-tree. It may likewise be procured by the action of nitric acid on sugar. It is obtained from the juice of the wild service-tree berries by adding acetate of lead, and subsequently sulphuric acid, or hydrosulphuric acid, by which the malic acid is set free.

The salts of this acid are generally soluble in water.

Composition:

1 hydrogen.
4 oxygen.
4 carbon.

Benzoic acid exists in benzoin, and in most of the balsams, in combination with resin. It may be obtained either by the application of heat, or by boiling benzoin in water, with carbonate of lime or potash. The benzoate is then decomposed by hydrochloric acid, and benzoic acid is separated.

Composition:

5 hydrogen.
3 oxygen.
14 carbon.
1 water.

Gallic acid is found in many vegetables, and generally associated with tannin. It is obtained in greatest quantity from the gall-nut, but in a pure state with much difficulty. To procure it, an infusion of gall-nuts is to be made, and allowed to stand for several days, during which period crystals of gallic acid are deposited. It is subsequently decolorized by the assistance of charcoal. Pure gallic acid requires 100 parts of cold water for solution. This acid is known by its forming a blue colour with the persalts of iron, and by forming insoluble compounds with metallic oxides; it is distinguished from tannin by not forming a precipitate with gelatine. Its precise composition is unknown.

Tannic Acid or *Tannin* is the principle which gives astringency to most vegetable substances, in which it generally exists with gallic acid. It is contained in large quantity in gall-nuts, kino, catechu, and oakbark. Pure tannic acid is colourless, but is procured in that state with much difficulty. It is soluble in water, ether, and warm alcohol, acquiring a yellow or brown colour when exposed to the air. It is chiefly known by its

effects on the salts of iron and gelatine; with the former it forms a dark black compound, which, with gallate of iron, forms the colour of ink; with the latter it forms tannogelatine, the basis of leather. An artificial tannin may be obtained by the action of nitric acid on charcoal, and some bituminous substances; also by the action of sulphuric acid on resin, camphor, &c.

VEGETABLE ALKALIES.

The vegetable alkalies, or alkaloids, as some chemists call them, are the active principles of many vegetables, and are composed of oxygen, hydrogen, nitrogen, and carbon. They exist in combination with some acid which gives them solubility, for in the pure state they are almost insoluble in water, sparingly soluble in cold alcohol, but freely soluble in boiling alcohol. They are all decomposed by great heat, and ammonia is one of the products.

Morphia. This alkaline principle of opium, in which it exists in combination with meconic acid, codeia, narcotine, resin, &c. may be procured by macerating opium in water. To the aqueous solution magnesia is added; and a meconate of magnesia, morphia, narcotine, and colouring matter are precipitated. The precipitate is then to be collected by filtration and washed with ether, to remove the narcotine and colouring matter; and subsequently the morphia is to be taken up by boiling alcohol; as the alcohol cools,

morphia is deposited in crystals. It may also be obtained by treating opium with dilute acetic acid, and then adding ammonia, which, by combining with the acetic acid, precipitates the morphia, which is to be collected and treated as in the former process.

The quantity of morphia in good opium is estimated at 7 drachms in the pound.

Composition:

35 carbon.
18 hydrogen.
6 oxygen.
1 nitrogen.

Morphia, from its insolubility, has very little action on the system; but with acetic, hydrochloric, sulphuric, citric, and other acids, it forms very soluble and energetic compounds.

Codeia, another alkaline constituent of opium, closely resembles morphia. If ammonia be added to the mixed hydrochlorates, morphia will be precipitated and codeia will remain in solution. Codeia is distinguished from morphia by its greater solubility in water, and by not being reddened by nitric acid.

Meconic acid is most readily procured by adding to a solution of opium acetate of lead or baryta, which causes a precipitate of meconate of lead or baryta. This meconate, treated with sulphuric acid or hydro-sulphuric acid, will afford free meconic acid.

Narcotine may be easily obtained by digesting an aqueous extract or solution of opium in sulphuric ether, which dissolves the narcotine, and leaves the meconate of morphia; by evaporation narcotine is left in white crystals.

Narcotine is soluble in oil, alcohol, and ether; insoluble in cold water, and sparingly soluble in hot water; acids render it soluble, and this appears to be effected by free meconic acid in opium. It does not possess alkaline properties.

Quinine, or *quinia*, the alkaline base of the cinchona cordifolia, may be procured by digesting the bark in very dilute sulphuric acid; when lime is added to the solution, a sulphate of lime is formed, and the quinia is precipitated. The precipitate is then to be washed with cold alcohol to remove colouring matter, and afterwards treated with boiling alcohol, which, on cooling and evaporation, leaves the quinine in a white flocculent state.

By similar processes we procure *cinchonia*, *strychnia*, *brucia*, and most of the other vegetable alkalies.

Oils are liquids having an unctuous feel; insoluble in water, and are inflammable, the chief products of their combustion being carbonic acid and water. They are compounds of oxygen, hydrogen, and carbon, and may be divided into fixed and volatile.

The *fixed oils* are procured from the seeds of plants or the pulpy covering, as in the olive, by pressure. They are all lighter than water; do not possess much colour; leave a greasy stain on paper; are volatilized with great difficulty, requiring a temperature of 600° for ebullition, and are even then partially decomposed; exposed to the air they absorb oxygen, become rancid, and acquire a property of drying: hence they are used for paint and varnishes: with oxide of lead

they form plasters, and with the alkalies they form soaps.

Oils are found to contain two proximate principles, named margarine and olëine: the former is the more solid portion; the olëine is the most fluid part. When an alkali is added to the oils, it is considered by Chevreul, and chemists generally, that these proximate principles are decomposed, and resolved into glycerine and margaric and oleic acids, which latter combine with the alkali, and glycerine remains liquid. Such is the theory of the formation of *soap*.

The *volatile* oils are obtained from many parts of plants by distillation. They vary much in specific gravity, some few being heavier than water. The oils heavier than water are those of cinnamon, sassafras, cloves, and pimenta. They differ also in their colour; do not leave a greasy stain on paper; are easily volatilized; are freely soluble in alcohol; do not form distinct soaps with alkalies; exposed to the air, they become thick, and acquire an appearance and properties like resin. The strong acids act on them with much violence, sometimes with the production of flame.

Camphor is a substance sui generis, intermediate between volatile oils and resins. It contains a large quantity of carbon, is soluble in spirit, fixed and volatile oils, and strong acetic acid, but very sparingly in water. It is now said to be a compound of oxygen with camphene.

Resins are juices of plants, which, when dry, are hard and brittle, and often of a yellow colour, they are soluble in alcohol, ether, alkalies, and oils, but quite insoluble in water. Hence water,

mixed with a spirituous solution of resin, by combining with the alcohol, precipitates or sets free the resin. They contain a large quantity of carbon and hydrogen; by combustion they yield carbonic acid and water, and likewise a quantity of charcoal, which is named lampblack.

Amber is a substance of vegetable origin. It is composed of bituminous matter, insoluble both in ether and alcohol, resin, succinic acid, and a volatile oil.

Balsams are ordinarily compounds of benzoic acid and resin, either in a solid or fluid state.

Gum-resins are juices of plants in which resin and gum are combined with a little essential oil and extractive matter, consequently they are most soluble in proof spirit. They afford many active medicines.

Caoutchouc, ordinarily known as Indian rubber, is an exudation from several trees growing in Asia and America. It is very inflammable, insoluble in water or alcohol, but is soluble in essential oils; slightly in pure ether, but most so in naphtha or petroleum. It is sparingly dissolved by the alkalies, and decomposed by sulphuric and nitric acids.

Wax is of animal as well as of vegetable origin. It is solid at ordinary temperatures; melts at 150 degrees: exposed to red heat is decomposed, forming products like those of fixed oils; insoluble in water; slightly soluble in hot ether and alcohol; miscible with fixed and volatile oils, and with resins; composed of two proximate principles, *cerin* and *myricin*, and with alkalies forms a saponaceous compound.

Bitumens are substances chiefly composed of

carbon and hydrogen. They are very inflammable, producing by their combustion carbonic and water: they are naphtha, petroleum, bitumen, mineral tar and pitch, asphaltum, retinasphaltum, and the many varieties of coal.

Naphtha is used to preserve potassium, as it contains no oxygen.

Some varieties of coal contain, besides the elements mentioned, oxygen and nitrogen, so that, when subjected to a red heat in close vessels, they afford coal tar, gaseous compounds of carbon with hydrogen, acetic acid, water, sulphuretted hydrogen, carbonic acid, sulphurous acid, and ammonia; *coke* being the solid residue. Reichenbach has discovered in coal tar six interesting combustible principles, they are paraffine, eupione, pittacal, picamar, capnomor, and creosote.

Sugar is the product of the saccharine fermentation, but is procured most abundantly from the juice of the sugar-cane, in which it exists in very large quantity; mixed with yeast, and heat being applied, it is decomposed, and alcohol is the product of the action, which is commonly known as vinous fermentation. It is a compound of 1 equivalent of oxygen, 1 hydrogen, and 1 carbon.

Starch is a proximate vegetable principle, often found in the seeds and other parts of plants. It may be procured from wheat-flour by making a paste and enclosing it in linen, and letting a stream of water run over it; the gluten is left, and the starch is removed and falls down in the water, from which it is separated in the solid state by evaporation. It may be procured by a similar process from potatoes.

Starch is particularly characterised by forming a dense blue compound with a solution of iodine. It is insoluble in cold water; soluble in hot water, which, on cooling, still keeps it suspended. Its constituents are like those of sugar, and may be considered isomeric with it. It is a very nutritious substance.

Gum is the principle which is found almost pure in gum arabic, and which, when dissolved in water, forms a viscid clammy liquid, called mucilage. It is soluble in cold or hot water, in which its solubility is increased by acids and alkalies; it is insoluble in alcohol and ether, which precipitate it; it is also thrown down by the diacetate of lead, as well as by several other metallic salts. Boiled with four times its weight of nitric acid it forms mucic acid; by strong sulphuric acid it is decomposed, giving rise to the formation of acetic acid, water, and charcoal.

Lignin, or woody fibre, which constitutes the bulk of all kinds of wood, is composed of oxygen hydrogen, and carbon. It is insoluble in water or alcohol, and undergoes no change by keeping. Boiled with strong sulphuric acid it is converted into gum, which by long boiling is converted into saccharine matter, like that from grapes; nitric acid decomposes lignin, forming malic, oxalic, and acetic acids.

The coloring matter named *litmus*, or turnsol, is obtained from the lichen roccella, a plant growing in the Canary Islands. The colour is produced by the mixture of an alkali with the substance of the plant, so that when an acid is brought in contact with the alkali, the red colour is set free.

Turmeric is procured from the root of the curcuma longa, which grows in the East Indies. Paper dyed with a solution of this substance is of a gamboge yellow colour, but becomes brown when brought into contact with an alkali.

The *fermentations* which occur in vegetable matter are four, namely, the *saccharine*, *vinous*, *acetous*, and *putrefactive*.

Saccharine fermentation takes place in malting, or the germination of seed, during which the starch, &c. are converted into sugar. There are four stages described in the process of malting, they are, steeping, couching, flooring, and kiln-drying.

The necessary conditions for this fermentation are, the presence of starch, a certain temperature and moisture; it is favored by access of atmospheric air and exclusion from light. During the process much carbonic acid is evolved.

Vinous fermentation. By this fermentation sugar is converted into alcohol. The requisites for it are sugar, moisture, yeast, or something to cause fermentation, and a certain temperature; the access of atmospheric air is not necessary, although favorable. During this change sugar is decomposed, losing oxygen and carbon in the proportions for forming carbonic acid; and alcohol is the product.

The *acetous fermentation* is that change which gives rise to the formation of acetic acid. The requisites are vegetable matter, moisture, a certain temperature, and access of atmospheric air. This process is not so well understood as the former. It is presumed that hydrogen and carbon are evolved in combination with the oxygen of the

air in the form of carbonic acid and water, leaving the elements in the proportions to form acetic acid.

Putrefactive fermentation leads to a complete decomposition of the substance; heat, air, and moisture are requisite. The products are water, oily matter, carbonic acid, carburetted hydrogen, acetic acid, and sometimes either hydrogen, nitrogen, or ammonia.

ANIMAL CHEMISTRY.

ANIMAL matter is composed of a number of proximate principles, which consist chiefly of four elements, viz. oxygen, hydrogen, nitrogen, and carbon; and which, like vegetable matter, admit of a division into acids, oily substances, and such as are neither acid nor oily.

Animal is distinguished from vegetable matter by possessing more nitrogen, and by its products when decomposed, either by heat or putrefaction, such as ammonia, sulphuretted and phosphoretted hydrogen, &c.

Fibrine is the proximate principle which in a great degree forms muscle; it is also contained largely in the crassamentum of the blood, from which it may be best obtained by stirring it up, when fresh drawn, with a stick. The adhering fibrine may be separated from the coloring matter by frequent washing.

Properties: insoluble in cold water; with alcohol it forms an adipocerous substance; it is decomposed by nitric acid, and evolves a great quantity of nitrogen; is dissolved by pure potash and ammonia The atomic composition of it is

presumed to be 18 of carbon, 5 of oxygen, 3 nitrogen, and 14 hydrogen.

Albumen exists in the white of egg, in the serum of the blood, in the fluid of serous cavities, and in a more solid state in cellular membrane, skin, and vessels. It is soluble in water, and in liquids is generally combined with some free soda; therefore the fluids containing it have an alkaline reaction. It is best characterised by being coagulated by heat. It forms precipitates with bichloride of mercury, tannin, and many metallic salts; it is coagulated likewise by galvanism and dilute acids. Its ultimate elements are the same as those of fibrine, and nearly in the same porportion.

Gelatine is found in the skin, tendons, cartilages, membranes, and bones; and in its purest state in isinglass. It does not exist in the healthy fluids of the body.

Properties: very soluble in warm water, becoming somewhat solid on cooling; forms a brittle mass when its water is expelled, as in glue; insoluble in alcohol; miscible with, or soluble in, weak acids and alkalies; has a feeble affinity for metallic oxides; does not precipitate bichloride of mercury; it forms a dense precipitate with tannin, called tanno-gelatine, which is the basis of leather. It is considered to be isomeric with albumen.

Urea is contained in urine, from which it is procured by the following process: evaporate urine to the thickness of syrup then add nitric acid, which will form a nitrate of urea, insoluble in iced cold water; to this after washing it repeatedly add carbonate of potash, which forms a nitrate of

potash, carbonic acid flies off, and the urea is set free; it is then to be taken up by water, and treated with charcoal to decolorize it: the solution being evaporated, urea is left. To obtain it in pure crystals, it may be repeatedly dissolved in alcohol.

Properties: colourless, transparent; faint smell, but not urinous; cool to the taste; very soluble in water; less so in alcohol; does not change litmus or turmeric paper: by heat is decomposed, forming carbonate of ammonia. It is composed of oxygen, hydrogen, nitrogen, and carbon, in the proportions for forming hydrated cyanate of ammonia.

Artificial urea has been obtained by the action of cyanate of silver on hydrochlorate of ammonia, affording the only instance in which an animal proximate principle can be imitated by artificial means.

Uric acid is found in the urine and gouty concretions; also in the solid excrement of the boa-constrictor, from which it is obtained most easily. This substance is treated with potash, and forms urate of potash, which is then decomposed by acetic or some other acid, and the uric acid is deposited. It is white, tasteless, and inodorous, requiring 10,000 times its volume of water at 60° for solution; mixed with nitric acid and heated, a purple colour is produced, owing to the formation of purpurate of ammonia. This acid unites with alkalies, and in that state is always found in the urine: when free it is deposited and forms a reddish sediment.

The following account of the composition of the various parts and fluids of the body is in ac-

cordance with the best authorities: but chemists differ so much in respect to their results of the analysis of many of them, that we may consider the subject quite in its infancy, and likely to be oftentimes remodelled before a general conclusion can be arrived at.

Blood when first drawn from an animal, appears to be an homogeneous fluid, but, if allowed to rest a short time, is separated into two distinct portions, the serum and crassamentum.

The *serum* or thin transparent part, is composed, according to Berzelius, of water, albumen, hydrochlorate of potash and soda, lactate of soda, and animal matter, and carbonate and phosphate of soda.

The *coagulum*, *cruor*, or *crassamentum*, contains fibrine, albumen, colouring matter, called hæmatosine, some salts, and peroxide of iron.

Saliva consists chiefly of water and mucus, but contains also hydrochlorate, phosphate, sulphate, lactate, carbonate, and sulphocyanate of potash, with phosphate of lime, and a trace of soda; the sulphocyanate causes it to produce a red colour, with a persalt of iron.

Salivary concretions are chiefly composed of carbonate and phosphate of lime.

Pancreatic juice somewhat resembles saliva, containing, in addition, albumen and ozmazome. This fluid, however, is distinguished from the saliva of the mouth by not containing sulphocyanic acid.

Bile is a greenish viscid fluid containing free soda, and composed of the following ingredients: water, albumen, resin, picromel, yellow matter,

several neutral salts of soda and potash, phosphate of lime, and oxide of iron.

The composition of this fluid, is described very variously by different chemical writers.

Gall-stones consist chiefly of adipocire, with a quantity of colouring matter, or according to Chevreul, of yellow colouring matter, and a peculiar principle, which he named cholesterine.

Chyle contains, besides water, fibrine, albumen, (named incipient by Prout,) and some salts.

Milk is composed of water, caseous matter, sugar of milk, hydrochlorate, phosphate and lactate of potash, lactate of iron, and earthy phosphates.

The chief components of *bone* are animal matter, phosphate and carbonate of lime, phosphate of magnesia, fluate of lime and water. The following is from the analysis of Berzelius :

Gelatine soluble in water . . .	32.17
Vessels	1.13
Subphospate of lime, with a little fluoride of calcium	53.04
Carbonate of lime	11.30
Phosphate of magnesia	1.16
Soda, with a trace of chloride of sodium	1.20
	100.0

The *brain* is composed of water, white fatty matter, red fatty matter, albumen, ozmazome, phosphorus, salts, acids, and sulphur.

Chalk-stones, or *gouty* concretions, are composed principally of uric acid and soda.

The *humours* of the eye consist of water, albumen, animal matter resembling gelatine, and several neutral salts.

Ligaments and *membranes* are composed chiefly of coagulated albumen and gelatine.

Gastric Juice has been obtained during late years by Dr. Beaumont in a much more separate and pure state than previously, so that its composition may be stated with greater confidence than before. On analysis it yielded to him and to others

Free hydrochloric acid
Acetic acid
Phosphate of potash, soda, magnesia, and lime
Hydrochlorates of the same basis
Animal matter.

Mucus of the nose contains water, mucous matter, salts of potash and soda, albumen, and animal matter.

Muscle consists chiefly of fibrine, with gelatine, ozmazome, albumen, neutral salts of soda, lime, and ammonia.

The *nails* are composed of coagulated albumen, gelatine, and a little earthy matter.

Synovia is a compound of water, fibrinous matter, albumen, salts of soda, and lime.

Tears contain water, albumen, mucus, and several neutral salts.

The *teeth* are formed of phosphate of lime, carbonate of lime and cartilage. The enamel is devoid of cartilage.

Tendons are composed principally of gelatine.

Pus is ordinarily a viscid liquid, of a yellow colour, slightly inclined to green, opaque and homogeneous, inodorous, possessing a feeble taste, neither acid nor alkaline, although it soon becomes acid on exposure to the air, with disengagement of ammonia: examined by the microscope,

it exhibits an appearance of globules. It is not soluble in water: and after agitation in it, falls to the bottom; is coagulated by boiling heat and diluted acids; is soluble in strong sulphuric and nitric acids; also in caustic potash, but is precipitated from them when water is added.

Brunefeld asserts that pus is coagulated by boiling with a solution of hydrochlorate of ammonia, but that mucus forms with it a clear mucilaginous liquid; when pus and mucus are diffused in water, the former sinks, the latter floats, or is suspended in it.

Urine is a limpid yellowish fluid, with an acid reaction, averaging in specific gravity 1.030. It is speedily decomposed when exposed to heat, and ammonia is generated in considerable quantity.

The urine contains, according to the analysis of Berzelius, somewhat more than $\frac{9}{10}$ths of water, urea, uric acid, free lactic acid, lactate of ammonia, hydrochlorate of soda and ammonia, combined with animal matter, mncus, sulphate of potash and soda, phosphate of soda and ammonia, earthy matters and silica.

In diseases, an excess of uric acid is indicated by sediments of a yellowish brown colour, sometimes pink, commonly known as lateritious sediment.

The precipitate is sometimes owing to the formation of purpurate of ammonia, or to rosacic acid.

Urinary calculi are various in their chemical nature, sometimes uniform in their structure and composition, but more frequently are formed of layers, differing from each other in their chemical constituents. The varieties of urinary calculi have

been amazingly multiplied by some chemical writers, but for practical purposes may be reduced to the following:

Uric acid calculus, the most common of all.

Character: usually brownish red, fawn or mahogany coloured; is decomposed by the blowpipe, leaving a white ash; completely soluble in caustic potash, but again precipitated by almost any acid.

The *Urate of ammonia calculus* is one of the most irritating to the system. It is generally smooth on its surface, composed of concentric layers, and seldom attains a large size. Before the blowpipe it decrepitates, is dissolved more easily than the uric acid calculus, and when heated with potash it evolves ammonia.

The *Mulberry* or *oxalate of lime calculus* has a dark reddish brown mamellated surface; it is convertible by the blowpipe into a white powder, and is soluble in nitric or hydrochloric acid; is very frequent in some districts.

The *Phosphate of lime calculus* is of a pale brown or grey colour, smooth, in regular laminæ; oval, sometimes very large; infusible before the blowpipe; soluble in hydrochloric acid, and then is thrown down by ammonia.

The *Ammonio-magnesian calculus* has generally a white or greyish uneven surface; it is rather compact, and imperfectly laminated; heated before the blowpipe it gives out ammonia, and leaves phosphate of magnesia as a residue.

This calculus often mixes with the preceding one, and they form together the fusible calculus of Wollaston; this is white on its surface, friable,

and has a great resemblance to chalk; soluble in hydrochloric acid; after which, if oxalate of ammonia be added, a copious oxalate of lime is precipitated.

Cystic oxide: generally of a yellowish white surface; internal appearance crystalline; easily dissolved by both acids and alkalies. It occurs of a small size, and is met with very rarely.

TOXICOLOGY.

Toxicology treats of the nature, antidotes, action, and tests of poisons.

Poisons are often described as of five kinds, corrosive, acrid, narcotic, narcotico-acrid, and septic; but, for all practical purposes, may better be restricted to three: irritant, narcotic, and narcotico-acrid. Irritant poisons include those which are corrosive, as strong acids and alkalies, as well as the powerful mineral substances, such as the preparations of arsenic, mercury, silver, antimony, copper, barytes, tin, zinc, the earths, phosphorus, &c.

The general symptoms produced by corrosive or irritant poisons, are heat, irritation, and dryness about the mouth, fauces, and œsophagus, with a sensation of constriction; vomiting, sometimes of blood; great pain in the stomach and bowels; thirst; copious evacuations by stool, with tenesmus, a sensation of constriction about the diaphragm, and difficulty of breathing; pain in the kidneys and strangury; convulsions; cramps in the hands; trembling of the lips; syncope; small, corded, and irregular pulse, and cold clammy perspirations: there is also sometimes a miliary eruption, or purple spots about the body.

The symptoms just described will not all be perceived in a single case, but are intended to represent such as may take place from these poisons collectively.

Corrosive sublimate is said to be known by the profuse salivation, the mercurial fœtor, swelling of the salivary glands, and diminished secretion of urine; however, these supposed diagnostic signs cannot be much depended on.

Copper has been distinguished by the coppery taste in the mouth, the severe gripings, and occurrence of jaundice.

Mineral acids are known by the destruction of the soft parts of the mouth; the matter vomited is black, and causes effervesence if dropt upon the hearth. The intellect is generally but little impaired. Nitric acid is known by giving out fumes of nitrous acid gas, and the yellow stains on the lips. Sulphuric acid blackens the lips and parts of the body with which it may have come in contact.

Potash, soda, and ammonia are distinguished by the urinous acrid taste; the vomited matter feels soapy, and commonly effervesces with acids.

Ammonia is known by the pungent odour which it evolves.

Morbid appearances produced by irritant poisons.—The alterations in the different parts will vary considerably, according to the greater or less chemical influence of the poison. Corrosive poisons, in addition to the common appearances produced by irritants, corrode and destroy by their chemical action the mucous membrane of the mouth, fauces, œsophagus, and stomach: whilst irritants not corrosive produce increased vascu-

larity and redness of the lining mucous membrane of the stomach and intestines, occasionally ulceration and perforation, a copious secretion of thick mucus, coagulable lymph, or extravasation of blood, and, in some cases, excoriation about the anus.

Treatment for corrosive irritant poisons.—The general treatment consists in evacuating the stomach as quickly as possible; but, as the action of the mineral acids, and some others, is so rapid, it is first necessary to administer antidotes to render the poison inert, and give tepid mucilaginous drinks, to make the vomiting as easy as possible. Castor-oil may afterwards be administered, and the inflammatory consequences treated on general principles. The stomach-pump must not be employed, when there is any suspicion of the soft parts being softened or corroded. Amongst the antidotes most efficacious may be enumerated the following:

White of eggs, lime-water or chalk mixed with milk, are considered the best for arsenic in solution.

The hydrated peroxide of iron has been reported to be an effectual antidote for arsenious acid.

White of eggs, for corrosive sublimate and preparations of copper.

Decoctions of yellow cinchona, galls, or tea, for tartar emetic.

Sulphate of magnesia, or soda, for the soluble salts of baryta.

Chloride of sodium, or table salt, for lunar caustic.

Magnesia, chalk, or soap-suds, for acids.

Oxalic acid requires the administration of chalk or magnesia, which are best given in a quantity of milk.

Some fixed oil should be given for alkalies; as it modifies the effect of the poison, by combining with it and forming a soap; vegetable acids, as vinegar or lemon-juice were formerly recommended but are not so useful as the oils.

VEGETABLE IRRITANT POISONS.

Amongst them are the helleborus niger and fœtidus, elaterium, colocynth, euphorbium, ricinus, ranunculi, delphinium, mezereum, juniperus sabina, jalapa, and convolvulus scammonea.

The symptoms are very similar to those produced by corrosive poisons, but milder. There is generally vomiting and purging, pain in the stomach and intestines, quick breathing and vertigo, syncope, labouring pulse, cold sweats, convulsions, and sometimes paralysis.

Treatment.—Assist the vomiting, if commenced, by mucilaginous drinks; if not excited, give from five to ten grains of sulphate of copper, or a scruple or two of sulphate of zinc. After the poison is evacuated, give coffee, acids, and camphor, according to circumstances, and combat the inflammation in the usual manner.

NARCOTIC POISONS.

The principal narcotic poisons are opium, lac-

tuca, hyoscyamus niger, solanum dulcamara, laurel-water, stramonium, &c.

Symptoms.—The symptoms of narcotic poisons, and of opium in particular, are, stupor, drowsiness, insensibility, and immobility, respiration scarcely perceptible, pulse small and feeble, but sometimes full and slow; as the effects increase, the lethargic state becomes more profound; swallowing is suspended; the breathing sometimes is stertorous; the pupil is contracted by opium, but dilated by other narcotics; the countenance pale and cadaverous: the muscles of the limbs and trunk are relaxed; sometimes there is vomiting, but the coma soon returns, and death, which is occasionally preceded by convulsions, speedily follows.

Treatment.—Administer a powerful emetic, such as half a drachm or two scruples of sulphate of zinc, assisted by copious mucilaginous drinks, and at the same time dash cold water over the head and chest. If the stomach-pump be at hand, inject plenty of gruel into the stomach, and endeavour to draw off the poison. After the poison has been satisfactorily evacuated, give coffee, vinegar and water, ammonia, or cordials. The patient should be sedulously kept awake till the symptoms have subsided. Strong coffee or tea is better for opium, and brandy and ammonia are the best remedies for digitalis. Orfila considers the best antidotes for prussic acid to be the inhalation of the vapour of ammonia, the administration of a weak solution of chlorine, and cold affusion over the head and along the back.

CANTHARIDES.

The principal symyptoms produced by cantharides are, the burning heat in the œsophagus and stomach, vomiting of blood, priapism, suppression of urine, attended with discharge of blood from the urethra. The appearances after death are those of inflammation of the lining mucous membranes.

The treatment consists principally in administering demulcents and antiphlogistics. No real antidote is yet known. The administration of oil is objectionable, as it increases the solubility of the cantharidine.

POISONOUS FISH.

Symptoms occasioned by them: sensation of weight at the stomach, nausea, vertigo, heat about the head and eyes, and occasionally tumefaction of those parts; colicky pains; thirst, and often urticaria.

The necessary treatment consists in administering an emetic, with copious draughts of warm water; then a purgative and anodynes. If excessive vomiting or spasms supervene, ether and ammonia should be given.

POISONOUS SERPENTS AND INSECTS.

The viper, rattlesnake, scorpion, &c.

Symptoms.—A sharp pain in the wounded part,

which soon extends over the limbs or body; great swelling, at first hard and pale, then reddish, livid, and gangrenous in appearance; faintings, vomitings, convulsions, and sometimes jaundice; pulse small, frequent, and irregular; breathing difficult; cold perspiration; the sight fails, and the intellectual faculties become deranged; inflammation and gangrene often supervene, and death soon follows.

Treatment.—Apply a ligature moderately tightened above the bitten part; allow the wound to bleed; after bathing and fomenting it well with warm water, apply freely to the wound the actual cautery, lunar caustic, or the butter of antimony; afterwards cover it with lint dipped in olive oil and hartshorn. Give warm diluent drinks, with ammonia, occasionally a little wine, and let the patient be well covered in bed to induce perspiration. Should gangrene threaten, wine and bark may be given more liberally.

A dry cupping-glass applied over the part has been found eminently successful in these cases, immediately after the infliction of the wound. It acts by preventing the absorption of the poison.

NARCOTICO-ACRID POISONS.

In this class are included those vegetable poisons which act locally, producing irritation and inflammation, and remotely giving rise to the effects of narcotism. In sufficient doses they usually prove fatal within twelve hours.

The symptoms occasioned by them closely re-

semble those produced by narcotics and irritants, and require no separate consideration.

These poisons are principally derived from the natural orders, solaneæ, umbellatæ, ranunculaceæ, and fungi. The most powerful are the atropa belladonna, solanum dulcamara, nicotiana tabacum, conium maculatum, cicuta virosa, œthusa cynapium, œnanthe crocata, aconitum napellus, helleborus niger, scilla maritima, digitalis purpurea, veratrum album, colchicum autumnale, nux vomica, camphor, and cocculus indicus.

Nux vomica is especially distinguished by the violent tetanic symptoms it produces.

The treatment to be adopted is the same as is generally necessary in poisoning by the narcotics.

TOXICOLOGICAL CHEMISTRY.

OR, TESTS FOR PRINCIPAL POISONS.

ARSENIC.

The following are the tests for arsenic:

Ammoniacal sulphate of copper, added to a solution of arsenic produces a green precipitate of arsenite of copper, called Scheele's green, sulphate of ammonia remaining in solution.

Ammoniacal nitrate of silver, added to a solution of arsenic, produces a lemon yellow precipitate of the arsenite of silver, leaving nitrate of ammonia in solution.

Sulphuretted hydrogen, transmitted through a solution of arsenic, produces a lemon yellow precipitate of sulphuret of arsenicum, or orpiment soluble in an excess of the gas. This precipitate may then be heated with black flux, and the metallic arsenic will be sublimed. This is one of the most certain tests for arsenic.

If arsenious acid be mixed with potash and charcoal, and heated in a glass tube, metallic arsenic sublimes and forms a brilliant metallic coating on the sides of the tube.

When metallic arsenic is thrown on burning coal, it vaporizes with a white smoke, and a smell resembling garlic.

When arsenic is tested for in the stomach, or mixed fluids, the substances submitted to analysis should be boiled with distilled water: acetic acid is employed to precipitate animal matter and charcoal to remove any colour. If the fluid be alkaline, or should alkali be added, it should not be in excess, as it prevents the falling down of the proper precipitate when tests are employed. The precipitates formed by the three tests first mentioned are all soluble in alkaline liquids.

The *hydrogen test* is performed as follows:

The suspected liquid is put into a bottle, and to this, metallic zinc and dilute sulphuric acid are added; water is decomposed by the zinc, and hydrogen is set free. This nascent hydrogen decomposes arsenious acid, and unites with arsenicum, forming gaseous arseniuretted hydrogen. This gas, passing off by a fine tube, is to be ignited at its exit, and by burning forms arsenious acid and water; a cold substance brought close to the burning gas will have the white arsenious acid deposited upon it, and if, by closer approximation of the cold body to the burning gas, the combustion be somewhat impeded, metallic arsenic may be seen in the centre of the arsenious acid.

The sources of fallacy may be, impure zinc containing arsenic, impure sulphuric acid, and the presence of antimony, which will give almost the same appearance as arsenic.

CORROSIVE SUBLIMATE.

The following are the best tests for corrosive sublimate in solution:

Protochloride of tin throws down a greyish black precipitate of metallic mercury, bichloride of tin being in solution. This is one of the most valuable tests for corrosive sublimate. If the precipitant be in a small quantity, a white precipitate, viz. calomel, will fall down. When the mercury falls, it is considered that two equivalents of protochloride of tin are engaged in decomposing one equivalent of bichloride of mercury.

Albumen produces a white precipitate of calomel and albumen, or a triple insoluble compound.

Galvanism.—Place a small quantity of the solution on a piece of gold, and bring into contact with it a key, or some piece of iron, so as to form a galvanic circle. If corrosive sublimate be present, the gold will be whitened, by the mercury uniting with the gold, and the chlorine passing to the iron.

Iodide of potassium throws down a precipitate of a bright scarlet colour, which is the biniodide of mercury; two equivalents of chloride of potassium remaining in solution. The precipitate is soluble in excess of the iodide of potassium, consequently it should be added very cautiously.

Hydrosulphates throw down a black precipitate, the sulphuret of mercury.

Solution of potash added to corrosive sublimate produces a red precipitate, the peroxide of mercury.

Lime-water added to corrosive sublimate produces a yellow precipitate of hydrated peroxide of mercury.

Ammonia added to corrosive sublimate produces a white precipitate, hydrargyri ammonio-chloridum of our Pharmacopœia.

If heated in a glass tube with carbonate of potash, globules of mercury may be obtained.

If it be necessary to procure corrosive sublimate from the tissues, they should be boiled with distilled water, and then ether may be added, which appears to dissolve this substance almost electively. The saline matter may be separated from the ether by heat, and dissolved in separate portions of water to apply the several tests.

PREPARATIONS OF COPPER.

The tests for the salts of copper are the following:

Ammonia produces a deep blue solution: at first a precipitate falls, which is subsequently dissolved by adding more ammonia.

Ferro-cyanide of Potassium produces a reddish brown precipitate, the ferro-cyanuret of copper.

Hydrosulphuric acid gives a black precipitate of sulphuret of copper. This precipitate, treated with nitric acid, decomposes the acid; takes oxygen to combine with the sulphur and form sulphuric acid, and with the copper to form an oxide, producing a sulphate of copper. If to this, ammonia be added, a beautiful blue colour will result. This is an excellent test of copper.

A clean plate of iron, immersed in a solution of sulphate of copper, will in a short time have a coating of metallic copper.

Heated in a crucible with charcoal, metallic copper may be obtained.

TARTAR EMETIC, OR POTASSIO-TARTRATE OF ANTIMONY.

The tests for tartar emetic are the following:

Hydrosulphuric acid, or *hydrosulphate of potash*, will throw down an orange-red precipitate, the hydrated sesqui-sulphuret.

Gallic acid, or *infusion of galls*, causes a whitish yellow precipitate, the tannate of antimony.

Sulphuric acid produces a white precipitate, soluble in an excess of the acid.

THE ACIDS.

The acids may be distinguished from other substances by the following tests: they convert most vegetable blues into red; they have a sour taste; the addition of an alkali destroys these properties.

The following are the acids most commonly used for poisoning: sulphuric, hydrochloric, nitric, oxalic, and hydrocyanic.

The tests for sulphuric acid are:

Chloride of barium, which produces a white precipitate of sulphate of baryta, insoluble in acids and alkalies.

Nitrate of lead, which produces a white precipitate, the sulphate of lead.

Tests for hydrochloric acid:

Nitrate of silver produces a copious white precipitate, the chloride of silver, soluble in ammonia, but insoluble in nitric acid.

Bring the fumes of the concentrated acid in contact with ammoniacal gas, and white fumes will be formed.

A little nitric acid being added to it, chlorine is set free, and it becomes a solvent of gold.

Tests of nitric acid:

Heated with many metals, nitrous acid fumes are evolved.

Mixed with a little hydrochloric acid it forms a solvent for gold leaf.

A crystal of morphia put into it first turns red, afterwards yellow.

Add to it a little carbonate of potash, and nitrate of potash will be formed: to be known by its prismatic crystals and deflagrating qualities.

The tests for oxalic acid are:

Chloride of Calcium, which causes a white precipitate of oxalate of lime, soluble in nitric acid, but insoluble in small quantities of hydrochloric acid.

Sulphate of copper throws down a bluish white precipitate of the oxalate of copper, which is insoluble in a few drops of hydrochloric acid.

Nitrate of silver throws down a white precipitate of the oxalate of silver, which, when dried and heated, fulminates.

By heat it is volatilized.

It crystallizes in six-sided prisms with dihedral summits.

Tests for the hydrocyanic acid:

Its odour like that of bitter almonds.

If potash be added, and then a solution of sulphate of iron, a greenish precipitate is produced. If to this, dilute sulphuric acid is added, a compound of a blue colour is formed, named Prussian blue.

Nitrate of silver forms a cyanuret of silver, insoluble in cold nitric acid, and which, when dried and heated, gives out cyanogen gas.

LEAD.

The tests for lead are the following:

Hydrosulphuric acid produces a black precipitate, the sulphuret of lead, which, on charcoal, by heat is easily reduced to a metallic state.

Chromate of potash, or *the iodide of potassium*, produces a gamboge yellow precipitate, the chromate or iodide of lead.

Infusion of galls produces a white precipitate of gallate of lead.

Sulphuric acid, or any soluble sulphate, produces a white precipitate, the sulphate of lead.

A piece of zinc put into the solution of acetate of lead causes the lead to be deposited in an arborescent manner.

SULPHATE OF ZINC.

The tests for the sulphate of zinc are:

Ferrocyanide of potassium, which produces a white precipitate.

Hydrosulphuric acid, and *the hydrosulphates*, produce a white precipitate, the hydrated sulphuret of zinc.

Alkalies produce a white precipitate, the hydrated oxide, which is soluble in excess of alkali.

Infusion of galls, producing no precipitate.

NITRATE OF SILVER.

The tests for nitrate of silver are the following:

Hydrochloric and the soluble hydrochlorates produce a white precipitate, chloride of silver, which becomes brown by exposure to light.

Arsenite of potash produces a yellow precipitate of arsenite of silver.

The solution stains the skin black.

Hydrocyanic acid causes a flocculent white precipitate of the cyanide of silver, soluble in ammonia, insoluble in cold nitric acid, but soluble in it when heated. By heat it is decomposed, and resolved into cyanogen and silver.

The pure alkalies throw down oxide of silver of a brown black colour.

Hydrosulphuric acid and hydrosulphates precipitate a black sulphuret of silver.

Mercury and most metals added to the solution cause metallic silver to be deposited.

Oxalic acid throws down a white oxalate of silver, which fulminates violently when heated.

IODINE.

The tests for iodine are the following:

It stains the skin brown.

It destroys vegetable colours like chlorine.

Heated in a tube it is converted into a violet-coloured gas.

A solution of starch added to it produces a dense blue compound.

THE ALKALIES.

The solutions of alkalies feel soapy to the touch; they change most vegetable reds and blues to green, and yellows to brown, and remain transparent when carbonic acid is added to them, which distinguishes them from the alkaline earths.

Potash may be distinguished from soda by the following tests:

Tartaric acid produces a precipitate of bitartrate of potash.
Chloride of platinum throws down a yellow precipitate.
Perchloric acid forms a compound with potash of very sparing solubility.

Soda does not form a precipitate with any acid.

Its salts exposed to the flame of a blowpipe, upon a platinum wire, produce a rich yellow colour.

THE ALKALINE EARTHS.

Lime may be detected by

Oxalate of ammonia, which causes a white precipitate, insoluble in an excess of oxalic acid.
Carbonic acid, which causes a white precipitate, soluble in excess of carbonic acid.

Baryta may be known by

The sulphuric acid, and all the sulphates producing a white precipitate, insoluble in nitric acid.

NITRATE OF POTASH.

The nitrate of potash may be distinguished by its crackling, and producing a white flame when

thrown on burning coals. Heated with sulphuric acid it produces nitrous fumes, and with the chloride of platinum it throws down a yellow precipitate.

HYDROCHLORATE OF AMMONIA.

The tests for hydrochlorate of ammonia are:

Quicklime rubbed with it causes an ammoniacal odour.

Nitrate of silver added to a solution of this salt causes a white precipitate.

MATERIA MEDICA.

ALTERATIVES

Are medicines which change the functions of the body, and restore them to a healthy state, without producing any sensible evacuation.

The principal alteratives are *mercurial* and *antimonial preparations*, in small doses; *sarsaparilla*, *guaiacum*, and *mezereon*.

ANTACIDS, OR ABSORBENTS,

Counteract and neutralize acidity in the stomach and intestinal canal, by their chemical action.

The principal antacids are *chalk*, *magnesia*, *potash*, *soda*, and *ammonia*.

ANTHELMINTICS, OR VERMIFUGES,

Are medicines which assist in the expulsion of worms either by dislodging or destroying them.

The anthelmintics, which act by exciting copious evacuations, are *calomel, scammony, gamboge,* and *spirits of turpentine.*

The mechanical anthelmintics are principally *mucuna pruriens, iron filings, powdered tin, male fern-root,* and *carbonate of iron.*

ANTISEPTICS

Are remedies supposed to be capable of resisting putrefaction.

The principal accredited antiseptics are *vegetable* and *mineral acids, cinchona, camphor, myrrh,* and *opium.*

ANTISPASMODICS

Are remedies supposed to have a specific effect in subduing that muscular contraction called spasm. This is of course effected through the medium of the nervous system.

The principal are *assafœtida, castor, opium, musk, galbanum, valerian, camphor,* and *ether.*

ASTRINGENTS

Are remedies which give rise to a contraction of fibre, by which means less fluid is admitted into the vessels brought in contact with them.

The principal astringents are *sulphuric acid,*

alum, *sulphate of copper*, preparations of *silver*, *iron*, *zinc*, and *lead*; *oak-bark*, *galls*, *tormentilla*, *bistort*, *logwood*, *catechu*, *kino*, *pomegranate*, and *cold*.

CARMINATIVES

Are those stimulating remedies which act by dispersing and preventing gaseous collections.

The principal are *oil of cinnamon*, *carraway*, *peppermint*, *aniseed*, and *essential oils* in general.

CATHARTICS

Are those medicines which produce an increase of alvine evacuations.

They may be classed under three heads, namely, laxatives, purgatives, and drastics.

Laxatives are digestible substances, and act gently on the muscular coat of the intestine, without causing any notable increase of secretion from the exhalants. Such are *manna*, *cassia fistula*, *tamarinds*, *figs*, *prunes*, *magnesia*, *olive* and *almond oil*, &c.

Purgatives are substances not very digestible; they often act on some particular part of the digestive tube, increasing the secretions, and actively augmenting muscular action The chief of them are *aloes*, *rhubarb*, *jalap*, *senna*, *castor-oil*, *balsams*, and several *neutral salts of soda*, *potash*, and *magnesia*, mild *mercurials*, &c.

Drastics have a still more powerful influence

upon both the muscular and mucous coat, causing a brisk action of the muscular fibres, and copiously exciting the exhalants of the mucous coat to pour out watery particles. Such are *elaterium, croton-oil, gamboge, colocynth, scammony, calomel, black hellebore, colchicum,* &c. With drastics might be classed *hydragogue cathartics,* which produce copious watery stools, such as *elaterium, saline purgatives,* &c.

DEMULCENTS

Are remedies of an oily or mucilaginous nature, which, by their viscidity, protect the intestines from acrid substances.

DIAPHORETICS

Increase the determination of perspiratory fluid to the skin. They effect this either by a general stimulating action on the system, or by relaxing the exhalants, so as to allow a more copious escape of fluid.

The principal are: *antimonials, ipecacuanha, acetate of ammonia, opium, camphor, guaiacum, mezereon, sassafras,* and *sulphur.*

DILUENTS

Are those bland fluids which tend to increase the proportion of watery fluid in the blood.

DIURETICS

Are medicines which excite an increased discharge of urine. They effect this in two or three ways. Some diuretics have a direct influence on the secerning vessels of the kidneys, entering them, and becoming perceptible in the urine. Such are *turpentine, copaiba, asparagus, nitre,* &c. Some undergo decomposition in the stomach, and one of their principles only enters the kidnies, as many *neutral salts,* in which the alkali alone passes into the urine. Others appear to act by giving tone to the vascular system generally, and thus, by propelling more fluid to the kidnies, more urine is secreted; a cool surface of the body and exercise are favorable to the action of diuretics.

The chief diuretics are *acetate, bitartrate,* and *nitrate of potash, nitric ether, squill, spirit of turpentine, copaiba, digitalis, tobacco, mercury, cantharides,* and *colchicum.*

EMETICS

Are those medicines which, being received into the stomach, excite the action of vomiting.

These are of two kinds, viz., those which produce immediate vomiting, without nausea or depression, but, on the contrary, leave behind them tonic effects: such are particularly the sulphates of copper and zinc. Hence they are most useful in debilitated habits, and in cases of poisoning.

The other class of emetics includes those the action of which is rather tardy, as *tartar emetic*, *ipecacuanha*, &c. They produce considerable nausea, and, after their operation, cause much depression of the system, and are, consequently, most serviceable in inflammatory diseases.

EMMENAGOGUES

Are those substances which tend to excite the menstrual discharge. Some act on the system generally, by regulating undue arterial action; others excite the torpid action of the uterine vessels, by a sympathetic effect, produced by purgatives, which stimulate the rectum.

The principal emmenagogues in common use are *aloes*, *assafœtida*, *galbanum*, various preparations of *iron*, *mustard*, *savine*, *rue*, and *madder*.

EMOLLIENTS

Are those substances which, applied externally, relax and soften the animal fibre.

The principal emollients are, *unctuous* substances and *liniments* with *warmth* and *moisture*.

ERRHINES

Are those substances which, being brought into contact with the pituitary membrane, excite the mucous follicles of the nose to increased secretion.

The principal are *tobacco*, *white hellebore*, *asarabacca*, and *euphorbium*.

ESCHAROTICS

Are substances which erode and destroy the parts to which they are applied.

The principal are *potash*, *nitrate of silver*, *mineral acids*, *sulphate of copper*, and *chloride of antimony*.

EXPECTORANTS

Are substances which produce a discharge of mucus from the lining membrane of the trachea and lungs. This effect is accomplished in two ways. In the first place, certain substances in a gaseous state received into the lungs stimulate the air-cells, and excite the respiratory muscles into action, by which means mucus is expelled by powerful coughing; some emetics may be considered to be of service in a similar manner. In the second place, there are medicines which, when received into the system, produce a powerful action on the exhalants, causing them to throw out a less viscid and more abundant fluid, which is expelled without much difficulty, and it is very probable that the vessels of the mucous bronchial lining are affected by sympathy with the stomach.

The principal expectorants are *antimonials*, *ipecacuanha*, *squills*, *digitalis*, *tobacco*, *stramonium*, *ammoniacum*, and the *balsams*.

LITHONTRIPTICS

Are substances which are supposed to act on urinary calculi.

They are *soda*, *potash*, *lime*, *magnesia*, and some of the acids.

NARCOTICS

Are medicines which induce sleep, and generally alleviate pain, partly by a stimulant or sedative action.

They act primarily on the stomach by an impression on the nervous system, independent of absorption; for in cases of death arising from them, they have been found in the stomach undiminished in quantity in the smallest degree; they also act on the nerves when externally applied.

The principal are *opium*, *hemlock*, *henbane*, *aconite*, *stramonium*, *belladonna*, *lactuca virosa*, *tobacco*, *hops*, *camphor*, and *nux vomica*.

SEDATIVES

Are substances which directly depress the vital powers, diminishing sensation and the power of motion without any previous excitement, but acting most powerfully on the nerves of sensation: in the medical application of them, they are of service to reduce preternaturally increased action.

The general effects of them, in different degrees of intensity, are prostration of strength, stupor, sense of numbness, depressed animal spirits, drowsiness, yawning, vertigo, and enfeebled mental energy.

The principal sedatives are *hydrocyanic acid* and *tobacco*, *opium* in full doses, &c.

SIALOGOGUES

Increase the secretion and discharge of saliva.

The principal are *tobacco*, *pellitory*, and *mercury*.

STIMULANTS

Are medicines which excite the various functions of the body, giving energy to the stomach, increased power to the heart, augmenting the secretions, and adding to the sensibility of the nervous system.

The principal effects experienced from them are, increased appetite, with a sense of warmth internally, more rapid action of the heart, increased power in the pulsation of the arteries, warm skin, with the minute vessels more injected with blood, the respiration accelerated, increased flow of urine, and the sensorial functions developed in a greater degree.

Stimulants in moderation have an action analogous to tonics, but their effects are less permanent. In large quantities they act as narcotics.

The principal stimulants are *alcohol*, *ether*, *volatile oils*, *camphor*, *ammonia*, and *aromatics generally*.

TONICS

Are those substances which restore the healthy tone of the stomach. They are supposed to act by increasing muscular power; but it is more probable that they are beneficial by checking the inordinate excitement or irritability of the stomach and viscera.

The principal are sulphate of *zinc* and *iron*, *acids* in small doses, and the *various bitters*, such as *cinchona*, *gentian*, &c.

MATERIA MEDICA.

ABIETIS RESINA.

A natural resinous exudation from the spruce Fir. Pinus Abies; Cl. Monæcia; Ord. Monadelphia; N. O. Conaceæ. This tree also affords Burgundy pitch, which is obtained from incisions made in the bark. These resins are principally brought from Germany.

Use.—Rubefacient in form of plaster.

ABSINTHIUM.

The leaves and tops of Common Wormwood. Artemisia Absinthium. Indigenous. Cl. Syng.; O. Superfl.; N. O. Synantheraceæ.

Use.—This bitter is given as a tonic and stimulant in dyspepsia and intermittent fevers and as a vermifuge.

Dose.—℈j. to ℈ij. of the powder, or in infusion.

ACACIÆ GUMMI.

The natural exudation from the Acacia Vera, which grows in Egypt, and other parts of Africa. Cl. Polyg.; O. Mon.; N. O. Leguminosæ.

Use.—As a demulcent, in catarrh and ardor urinæ, also to suspend insoluble substances in liquids.

Dose.—℈j. to ℈ij.

ACETOSÆ FOLIA.

The leaves of Common Sorrel, Rumex Acetosa. Indigenous. Cl. Hexand.; O. Digynia; N. O. Polygonaceæ.

Use.—This plant may be given as a refrigerant and diuretic in fevers and inflammations, but is very rarely used.

Dose.—Of the leaves, ad libitum, of the juice, ℥ss. to ℥j.

ACETOSELLA.

The leaves of Oxalis Acetosella, Wood Sorrel. Indigenous. Cl. Dec.; O. Pentag; N. O. Oxalidaceæ.

Use.—This plant may be administered as the former. They both owe their virtues to the superoxalate of potash.

ACETUM.

Vide Decompositions.

ACONITI FOLIA.

The leaves of Aconitum Paniculatum. This plant grows in Germany, the Alps, and Pyrenees, and is sometimes cultivated in our gardens. Cl. Polyand; O. Trig.; N. O. Ranunculaceæ.

Use.—It has been given in syphilis, chronic rheumatism, and as a diuretic in dropsies.

Dose.—Gr. j. to gr. iij. of the extract, of the powdered leaves iv. or v. grains.

ACORUS.

The Rhizome of Acorus Calamus. Sweet flag. Indigenous. Cl. Hexandria; O. Monog.; N. O. Acoraceæ.

Use.—Stomachic, aromatic, and tonic.

Dose.—℥j. to ℥ss. in infusion or decoction.

ADEPS.

The prepared fat of the Sus Scrofa, Hog. Used only in making ointments.

ÆRUGO.

The impure subacetate of copper or verdigris is obtained in France by immersing plates of copper in the husks and refuse of expressed grapes, and by exciting in them the acetous fermentation.

Use.—It has been given as a tonic in epilepsy, and acts as an emetic. It is also applied to ulcers externally as a detergent or escharotic.

Dose.—As a tonic gr. $\frac{1}{8}$ to gr. $\frac{1}{2}$; as an emetic gr. ij. to gr. v.

Prep.—Linimentum Æruginis.

ALLIUM.

The bulbs of the Allium Sativum, Garlic. Cl. Hexand.; O. Monog.; N. O. Liliaceæ.

Use.—This plant is principally used as an anthelmintic, and has been given as a stimulant, expectorant, and diuretic, in catarrh, asthma, and dropsy. Externally applied, it acts as a stimulant and rubefacient.

Dose.—3ss. to 3ij. of the juice, or two or three of the cloves.

ALOE.

The inspissated juice of the leaves of Aloe Spicata, Spiked or Socotrine Aloes. Cl. Hexand.; O. Monog.; N. O. Liliaceæ. The drug is obtained by cutting the leaves off the plant, allowing the juice to run out, and drying it in the sun. It is likewise said to be procured by boiling the leaves, and evaporating the decoction. It is brought principally from the Cape of Good Hope and Bombay.

Use.—A warm, stimulating purgative, acting chiefly on the large intestines, particularly the rectum, and is very liable to produce hæmorroids; hence it is considered improper in that disease, also in pregnancy, in menorrhagia, and fistula in ano; and indeed in any inflammatory disease of the pelvic viscera. It is esteemed an emmenagogue, stomachic, and anthelmintic. Administered as an enema, with carbonate of potash, it removes ascarides. In moderate doses it acts chiefly on the muscular coat, producing bulky and rather solid evacuations.

Dose.—Gr. i. to ij. as a tonic, as a purgative gr. v. to gr. viij.

ALTHÆÆ FOLIA ET RADIX.

The leaves and root of Marsh Mallow, Althæa Officinalis. Indigenous. Cl. Monad.; O. Polyand.; N. O. Malvaceæ.

Use.—The decoction is given as a demulcent, in visceral inflammations and calculous disorders.

Dose.—Almost ad libitum.

ALUMEN.

The sulphate of alumina and potash. Alum is usually obtained by burning schistose pyritic clays, or alum

ores; in which case the oxygen of the atmosphere forms sulphuric acid with the sulphur of the iron, and the sulphuric acid, combining with the alumina, forms sulphate of alumina, which is afterwards mixed with potash.

Use.—This salt is astringent and styptic. It is given internally in hæmorrhages and gleet; and used externally in ophthalmia; as a gargle for relaxed uvula; and also as an injection in gleet.

Alumen exsiccatum is a mild escharotic.

Dose.—Gr. x. to ℈j.

Ammoniacum.

A gum resin, supposed to be produced from the Dorema Ammoniacum, brought from Persia. Cl. Pent.; O. Digyn.; N. O. Umbellatæ. It exudes from the stem, which is cut off just above the ground.

Use.—It is a stimulating expectorant, and may be given in asthma, or in the chronic catarrh of old persons. It is also given as an emmenagogue, and acts as a stimulant applied externally, as a plaster.

Dose.—Gr. x. to ℥ss.

Ammoniæ Hydrochloras.

Hydrochlorate of Ammonia is obtained by the destructive distillation of bones and refuse animal matter, such as wool, horn, &c., and likewise from gas liquors. The ammoniacal liquor thus obtained is saturated with sulphuric acid, and subsequently decomposed by chloride of sodium; sulphate of soda remains in the retort, and hydrochlorate of ammonia is sublimed.

Use.—This salt is diuretic and aperient, but seldom given internally. It is more used externally, in solution, as a cold discutient lotion, and in pharmacy to procure other ammoniacal preparations.

Ammoniæ Liquor Fortior.

Sp. g. .882; vide Decompositions.

Amygdala Amara. } ——— Dulcis. }

They are both varieties of the Amygdalus Communis,

growing in Spain and Italy. Cl. Icosand.; O. Monog.; N. O. Rosaceæ. The bitter almond contains elements which will produce hydrocyanic acid.

Use.—Almonds are given as demulcent and sedative, in coughs, in the form of emulsion, which is readily made by triturating them with water. Almond emulsion is sometimes made extemporaneously by mixing almond oil with a little liquor potassæ and distilled water.

Amylum.

The Fæcula of the seeds of Triticum Hybernum, Wheat. Cl. Triandria; O. Digynia; N. O. Graminaceæ. The starch is obtained by steeping wheat in water, and then expressing the juice, which is diffused through water and falls down as an impalpable powder.

Use.—It acts as a demulcent in dysentery and diarrhœa, but is principally used in decoction, as a vehicle for opiate and other injections.

Anethum.

The fruit of Anethum Graveolens, Dill; a native of the south of Europe. Cl. Pent.; O. Digyn.; N.O. Umbellatæ. This plant, like all the other aromatic plants in the same natural order, owes its virtues to the presence of a volatile oil.

Use.—It is given as a carminative to infants, in the form of dill water, or in powder.

Anisum.

The fruit of Pimpinella Anisum; a native of Spain and Egypt. Cl. Pent.; O. Digyn.; N. O. Umbellatæ.

Use.—The same as of dill.

Anthemis.

The single flowers of the Anthemis Nobilis, Chamomile. Indigenous. Cl. Syn.; O. Superfl.; N. O. Syantheraceæ. They are said by chemists to contain piperine, but the bitterness is occasioned by a volatile oil.

Use.—Chamomile flowers are tonic and carminative,

and are useful in dyspepsia, gout, and colic. The warm infusion is emetic.

Dose.—Gr. x. to ℈j. in powder or in infusion.

ANTIMONII SESQUI-SULPHURETUM.

Sulphuret of Antimony; a natural ore, used to prepare the three antimonial preparations of the Pharmacopœia.

ARGENTUM.

Purified Silver, used to make the Argenti Nitras.

ARMORACIA.

The recent root of Horseradish, Cochlearia Armoracia. Indigenous. Cl. Tetrad.; O. Siliculosa; N. O. Brassicaceæ. It contains a volatile oil, which is the sharp acrid ingredient.

Use.—It is stimulant and diuretic, and may be given in chronic rheumatism and dropsy, and used externally as a rubefacient.

Dose.—℈j. to ℥j.

ASARUM.

The leaves of the Asarum Europæum. Asarabacca. Indigenous. Cl. Dodec.; O. Monog.; N. O. Aristolochiaceæ.

Use.—The powdered leaves are irritating, and used as a snuff in ophthalmia and headach. Taken internally they are emetic and cathartic.

ASSAFŒTIDA.

Assafœtida is obtained in Persia by cutting off the stem of the Ferula Assafœtida, and allowing the juice to exude. It is then exposed to the sun, and hardened. It is a gum-resin, with a powerfully odoriferous volatile oil. Cl. Pent.; O. Digyn.; N. O. Umbellatæ.

Use.—It is given as a stimulant, antispasmodic, emmenagogue, expectorant, and anthelmintic, in hysteria and nervous diseases, spasmodic coughs, amenorrhœa, and worm cases.

Dose.—Gr. v. to gr. xx.

AVENA.

The detorticated seeds of the Avena Sativa, common Oat. Cl. Triandria; O. Digynia; N. O. Graminaceæ.

Use.—Demulcent and nutrient in visceral inflammations, and as a vehicle for injections.

AURANTII BACCÆ CORTEX, FLORES ET OLEUM.

The berries, rind, flowers, and oil distilled from the flowers of Citrus Aurantium, a native of Spain and Italy. Cl. Polyadelphia; O. Icosand; N. O. Aurantiaceæ.

Use.—The peel is a tonic and stomachic. The berries are used in issues in place of peas.

BALSAMUM PERUVIANUM.

Peruvian Balsam is obtained by boiling in water the twigs of the Myroxylon Peruiferum, which grows in South America. Cl. Decand.; O. Monogy.; N. O. Amyridaceæ

Use.—It is given as a tonic and expectorant in asthma, catarrh, leucorrhœa, and chronic rheumatism.

Dose.—*M.* x. to *m.* xxx.

BALSAMUM TOLUTANUM.

The concrete Balsam of the Moroxylon Peruiferum.

Use.—The same as the Balsam of Peru.

BARYTÆ CARBONAS.

This is only used in pharmacy to prepare the Chloride of Barium, the best test of the presence of sulphuric acid in solution.

BELLADONNÆ FOLIA.

The leaves of the Atropa Belladonna, or Deadly Nightshade. Indigenous. Cl. Pentandria; O. Monogynia; N. O. Solanaceæ.

Use.—It is narcotic but seldom given internally; externally it may be applied as a plaster to allay pain, and to the eye to produce a dilatation of the pupil, in iritis and cataract.

Dose.—Gr. ¼ to gr. j. of the extract or powdered leaves.

BENZOINUM.

Benzoin is produced from incisions made in the bark of the Styrax Benzoin, which grows in Sumatra and Java. Cl. Dec.; O. Monog.; N. O. Styraceæ. It consists chiefly of resin and Benzoic acid.

Use.—The same as tolu or balsam of Peru.

BERGAMII OLEUM.

The oil distilled from the rind of the fruit of Citrus Limetta Bergamotta. Cl. and O. the same as of Citrus Aur. It comes from Italy.

The oil is used to cover the unpleasant odour of some ointments.

BISMUTHUM.

Bismuth is a simple metallic body, generally found native or sparingly oxidised, or combined with sulphur and several metals. It melts at a low temperature; is brittle, lamellated and of a yellowish white colour. It is not used medicinally in its pure state.

BISTORTÆ RADIX.

The root of Polygonum Bistorta, Bistort. Cl. Octand.; O. Trigy.; N. O. Polygonaceæ. Chief active principle, tannin.

Use.—It is tonic and astringent, given in hemorrhage and diarrhœa, and is used with much benefit as an injection in discharges from the urethra and vagina.

Dose.—Gr. x. to 3ss.

BORAX.

The Biborate of Soda, found native in some parts of India and Thibet.

Use.—Detergent in aphthæ, especially for children.

Dose.—Gr. v. to gr. xv.

BROMINIUM.

Bromine, an elementary substance, used in preparing Bromide of Potassium. Not administered in its simple state.

Vide Decompositions and Chemical Notes.

CAJUPUTI.

Cajuput oil is obtained in Amboyna and Borneo by distilling the leaves of the Melaleuca Minor. Cl. Polyadelphia; O. Icosan.; N. O. Myrtaceæ.

Use.—It is stimulant, antispasmodic, and diaphoretic, given in chronic rheumatism and spasmodic colic. It is an elegant ingredient in liniments and embrocations.

Dose.—*M.* v. to *m.* x.

CALAMINA.

Calamine, or the impure Carbonate of Zinc, is a natural ore, generally mixed with other ores and stony substances. It is used externally as an application to ulcers, in the state of calamina preparata, either sprinkled on as a powder, or with Ceratum Cetaceum, forming Turner's cerate.

CALCIS HYDRAS.

Fresh burnt lime slaked by water.

CALUMBA.

The root of a plant growing in Southern Africa, supposed to be the Cocculus Palmatus. Cl. Diœcia; O. Dodecand.; N. O. Menispermaceæ. This root contains a large quantity of starch, which affords a blue colour when a solution of iodine is applied to it. This root is devoid of tannin and gallic acid.

Use.—Calumba root is given as a tonic in diarrhœa, vomitings attendant on pregnancy, and in cholera.

Dose.—Gr. x. to ℈j. of the powder; of the infusion ℥jss.

CAMBOGIA.

Gamboge exudes from the broken twigs of the Stalagmitis Cambogioides, and is brought from Ceylon. Cl. Polygamia; O. Monœcia; N. O. Guttiferæ. The substance from it, consists of gum and resin, with a yellow colouring matter.

Use.—It is a drastic purgative, and hydragogue, and is administered in dropsies, obstinate costiveness, and worm cases. It particularly acts on the upper part of

the intestinal canal, and is on that account often prescribed with aloes.

Dose.—Gr. ij. to gr. v.

CAMPHORA.

Camphor is obtained by distillation from the branches and leaves of the Laurus Camphora, a native of the East Indies. Cl. Enn.; O. Monog.; N. O. Lauraceæ. It is also obtained from the Dryobalanops Camphora, in which it is found in a concrete state, and exists in a small proportion in most of the Labiatæ.

Use.—It is a stimulant and diaphoretic, and may be given in typhus, hysteria, convulsions, and mania.

Dose.—Gr. v. to gr. x.

CANELLA.

The bark of the Canella Alba, brought from the West Indies. Cl. Dec.; O. Monog.; N. O. Clusiaceæ. The bark is obtained from the younger branches of the tree. Its proper menstruum is spirit, and its solution is not affected by the salts of iron.

Use.—Stimulant and aromatic; used as an adjunct to bitters.

Dose.—Gr. x. to 3ss.

CANTHARIS.

Cantharis Vesicatoria, or Officinalis, of the order Coleopteræ, section Heteromères, and family Trachelides, of Cuvier. This insect is now principally brought from Russia. It is said to be most irritating during the period of copulation.

Use.—Blistering flies, given internally, act as a stimulant and diuretic, and have been prescribed in gleets, dropsies, and paralysis of the sphincter vesicæ; they are injurious in inflammation of the kidney. Externally they are used to blister the skin.

Dose.—Gr. j. to gr. iij. of the powder, of the tincture *m.* x. to 3ss.

CAPSICI BACCÆ.

The berries of the Capsicum Annuum, a native of India. Cl. Pent.; O. Monog.; N. O. Solanaceæ.

Use—They are stimulant, and may be given in dyspepsia, chronic gout, and rheumatism; most commonly employed in gargles.

Dose.—Gr. v. to gr. x.

Carbo Animalis.

Animal Charcoal, obtained by the imperfect combustion of flesh and bones, generally used to decolorize liquids.

Carbo Ligni.

Wood Charcoal, obtained in a like manner from woody substances.

Use—Slightly aperient and antiseptic.

Dose.—℥j. to ℥ss.

Cardamine.

The flowers of Cardamine Pratensis, or Cuckoo Flower. Indigenous. Cl. Tetrad.; O. Siliquosa; N. O. Brassicaceæ.

Use.—They are said to be stimulant and diaphoretic, and are recommended in convulsions and spasmodic diseases.

Dose.—℈j. to ʒj.

Cardamomi Semina.

The seeds of the Alpinia Cardamomum, brought from Bengal. Cl. Monand.; O. Monog.; N. O. Zingiberaceæ.

Use.—They are stimulant and carminative, generally given to prevent the griping occasioned by purgatives.

Dose.—Gr. v. to ℈j.

Carui.

The fruit of the Carum Carui. Indigenous. Cl. Pentandria; O. Digynia; N. O. Umbellatæ.

Use.—Carminative, and generally prescribed as an adjunct to other medicines.

Dose.—Gr. x. to ℈j.

CARYOPHYLLUS.

CARYOPHYLLI OLEUM.

Cloves are the dried unexpanded flower-buds of the Eugenia Caryophyllata, which grows in the Moluccas. The oil is expressed from them. Cl. Icos.; O. Monog.; N. O. Myrtaceæ.

Use.—Stimulant and aromatic, given in gout and dyspepsia.

Dose.—Gr. x. to ℈j.

CASCARILLA.

The bark of Croton Cascarilla, a native of the Bahama Islands. Cl. Monœcia; O. Monadelphia; N.O. Euphorbiaceæ.

Use.—Tonic and stomachic, given in dyspepsia and intermittents.

Dose.—℈j. to ʒj.

CASSIA.

The pulp of the pods of the Cassia Fistula, named by some Cathartocarpus Cassia, brought from the East and West Indies. Cl. Decand.; O. Monog.; N. O. Leguminosæ.

Use.—Laxative; given chiefly to children.

Dose.—ʒiv. to ℥j.

CASTOREUM.

Castor is found in follicles, situated between the anus and genitals of the Castor Fiber, a native of north Europe, Asia, and America.

Use.—Antispasmodic; given in hysteria and nervous diseases.

Dose.—Gr. v. to ℈j., of the tincture ʒj. to ʒij.

CATECHU EXTRACTUM.

The extract obtained from the inner wood of the Acacia Catechu, a native of Hindoostan. There are several varieties of it; the pale, in squares, from Bengal, and the dark, in large rounded masses, from Bombay. C. Polyg.; O. Monœcia; N. O. Leguminosæ.

Catechu contains a great proportion of tannin, and a very small quantity (if any) of gallic acid.

Use.—It is astringent, and is given in hæmorrhages and diarrhœa; also used in cases of relaxed uvula. Its virtues are destroyed by alkalies.

Dose.—Gr. x. to ℈ij.

CENTAURIUM.

The tops of the Erythræa Centaurium, common Centaury. Indigenous. Cl. Pent.; O. Monog.; N. O. Gentianaceæ.

Use.—Tonic and diaphoretic, given in dyspepsia, and might be well substituted for gentian.

Dose.—Gr. xv. to 3j.

CERA ALBA }
CERA FLAVA. }

Substances deposited by the apis mellifica, used in making ointments.

CEREVISIÆ FERMENTUM.

Yeast is said to be antiseptic, and has been recommended in typhoid fever. It is more used as a cataplasm to foul ulcerated surfaces.

CETACEUM.

Spermaceti is found in spongy masses in cells of cranium of the Physeter Macrocephalus of the Southern Ocean.

Use.—It is demulcent and emollient; given internally in dysentery and catarrh, but principally used in making ointments.

Prep.—Cerat. Cetacei; Ung. Cetacei.

CETRARIA.

The Cetraria Islandica, formerly named Lichen Islandicus. Cl. Cryptogamiæ; O. Lichenes.

Use.—Demulcent and gently tonic; given in Phthisis, and coughs generally.

Dose.—Of the decoction ad libitum.

CHIMAPHILA.

The leaves of Chimaphila Corymbosa, Winter Green,

a native of North America. Cl. Decand.; O. Monog.; N. O. Pyrolaceæ.

Use.—This plant is diuretic and tonic.

Dose.—Gr. x. to ℈j, or ℥iss of the decoction.

Cinchonæ Cordifoliæ Cortex.
Cinchonæ Lancifoliæ Cortex.
Cinchonæ Oblongifoliæ Cortex.

The varieties of Cinchona are very numerous: they are found most abundant in the districts of Peru. The different species are not yet all accurately and precisely defined, but they are divided on account of their colour, into four kinds: the grey, the yellow, the red, and the white. Amongst the grey Cinchonas, is the Cinchona Lancifolia of the Pharmacopœia, said to be Cinchona Condaminea; of the yellow kind, the Cinchona Cordifolia, correctly named Lancifolia; and of the red, the Cinchona Oblongifolia or Magnifolia. Cl. Pentand.; O. Monog.; N. O. Cinchonaceæ. The grey or quilled Bark affords the most Cinchonine, the Cordifolia the most Quinine, and the Oblongifolia contains both Quinine and Cinchonine combined with kinic acid.

Use.—Tonic and astringent, principally administered in intermittent fevers, after long fevers and inflammations, and most diseases assuming an intermittent type. In some habits Cinchona acts as a purgative, and is very liable to occasion very severe headaches. It is contra-indicated in plethoric and inflammatory states of the body.

Dose.—Of the powder ℥ss. to ℥ij., of the disulphate of quina gr. ij. to gr. v.

Cinnamomi Cortex et Oleum.

The inner bark named liber, of the Laurus Cinnamomum, a native of Ceylon. A pound of bark affords about 1 drachm of essential oil. Cl. Enneand.; O. Monog.; N. O. Lauraceæ.

Use.—Stimulant, carminative, and astringent, &c.

Dose.—Gr. v. to ℈j.

Cocci.

The body of the dried female Coccus Cacti, brought from Mexico, Georgia, and South Carolina.

Use.—Only as a colouring matter, but has been employed as an antispasmodic in hooping-cough.

COLCHICI CORMUS ET SEMINA.

The Cormus and Seeds of the Colchicum Autumnale or Meadow Saffron. Indigenous. Cl. Hexand.; O. Trig.; N. O. Colchicaceæ. The bulb should be dug up in May, June, or July. The active principle is Colchicia.

Use.—It is sedative, diuretic, and cathartic, and acts nearly as a specific in gout and rheumatism. It is considered by many to be beneficial in gout solely from its purgative properties, exciting a copious secretion of bile, and thus stimulating the intestines. Notwithstanding this opinion, Colchicum diminishes the pain in gout, and lowers the vascular action long before any purgative effect is produced.

Dose.—Gr. ij. to gr. vj. of the powder, 3j. to 3ij. of the acetum, and *m.* x. to 3ss. of the Vinum and Tinctura Colchici, of the extract j. to iij. grs.

COLOCYNTHIS.

The dried pulp of the Pepoes of the Cucumis Colocynthis or Bitter Cucumber, which grows in Turkey. Cl. Monœcia; O. Monand.; N. O. Cucurbitaceæ.

Use.—Violently cathartic, seldom given alone.

Dose.—Gr. ij. to gr. v.

CONII FOLIA ET FRUCTUS.

Leaves and fruit of the Conium Maculatum or common Hemlock. Cl. Pent.; O. Digy.; N. O. Umbellatæ.

Use.—Hemlock is an anodyne and narcotic, producing its effects without stimulation. It is often used as a substitute for opium, particularly when there is much febrile excitement. It is useful in pulmonary diseases in general, scirrhus, rheumatism, and in scrofula.

Dose.—Gr. ij. to gr. x. of the powder or extract.

CONTRAJERVA.

The root of Dorstenia Contrajerva, brought from Peru and Mexico. Cl. Tetrand.; O. Monog.; N. O. Urticaceæ.

Use.—Tonic and diaphoretic, given in typhoid fevers and diarrhœa.

Dose.—Gr. x. to 3ss.

COPAIBA.

The liquid resin from holes bored in the trunk of the Copaifera Officinalis of South America. Cl. Dec.: O. Monog.: N. O. Amyridaceæ. It is composed of resin and volatile oil.

Use.—Diuretic and stimulant, given in gleet, leucorrhœa, &c.

Dose.—*M.* x. to 3j.

CORIANDRUM.

Fruit of the Coriandrum Sativum. Indigenous. Cl. Pent.; O. Digyn.; N. O. Umbellatæ.

Use.—Carminative and stomachic.

Dose.—℈j. to 3j.

CORNU.

Hartshorn Shavings are nutrient and demulcent when reduced to the state of jelly.

Cornu Ustum is chiefly phosphate of lime.

Dose.—Ad libitum.

CREASTOON.

Creasote, a liquid procured from Coal-tar. Its name is derived from two Greek words κρεας flesh, and σωζω to preserve.

Use.—It checks vomiting, relieves toothach speedily, and is used externally as an application to ulcers.

Dose.—j. to v. drops.

CRETA.

Chalk, the friable carbonate of lime, found abundantly in many parts of England.

Use.—Antacid, and indirectly astringent, given chiefly in diarrhœas.

Dose.—℈j. to 3j.

CROCUS.

The pistils of the Crocus Sativus, or common Saffron Indigenous. Cl. Triandria: O. Monog.: N. O. Iridaceæ. The colouring matter of the saffron is named polychroite.

Use.—Antispasmodic and stimulant, recommended in

chlorosis and nervous affections, most used as a colouring matter.

Dose.—Gr. x. to 3ss.

CUPRI SULPHAS.

Sulphate of Copper is made either by roasting copper pyritic ores, or by heating copper with sulphur, then calcining it, and afterwards digesting it in dilute sulphuric acid.

Use.—Given as a tonic in epilepsy and intermittents: emetic and escharotic.

Dose.—Gr. ¼ to gr. j. as a tonic, gr. v. gr. x. as an emetic.

CYMINUM.

The fruit of the Cuminum Cyminum. Cl. Pent.: O. Digy.: N. O. Umbellatæ.

Use.—Carminative, taken internally: applied externally, they are stimulant and discutient.

Dose.—℈j. to 3j.

CURCUMA.

The rhizome of Curcuma Longa, Turmeric Plant, which grows in the East Indies. Cl. Mon.: O. Monog.: N. O. Zingib.

Use.—Turmeric is aromatic and stimulant, but it is chiefly employed to colour paper, which is used as a test to the presence of alkalies.

CUSPARIÆ CORTEX.

The bark of the Galipea Cusparia, which grows in South America. Cl. Decand.: O. Monog.: N. O. Rubiaceæ.

Use.—Tonic and stimulant, given in intermittents and dyspepsia.

Dose.—Gr. x. to ℈j.

CYDONIA.

The seeds of Cydonia Vulgaris, the Quince Tree. Cl. Icosand.: O. Pentag.: N. O. Pomeæ. They contain a large quantity of mucilage, two drachms being sufficient to make a pint of water thick and viscid.

Use.—Emollient and demulcent in coughs.

Dose.—Ad libitum.

Dauci Radix et Fructus.

The fruit and root of the Daucus Carota. Indigenous. Cl. Pent.: O. Digy.: N. O. Umbellatæ.

Use.—The seeds are carminative, and, some say, diuretic; the root is used in the form of poultice, which is emollient, and said to correct the fetor of the phagedenic sores.

Dose.—Gr. x. to ℈j. of the bruised seed.

Digitalis Folia et Semina.

The leaves and seeds of common Foxglove, Digitalis Purpurea. Cl. Didyn.: O. Angiosp.: N. O. Scrophulariaceæ.

Use.—Diuretic and sedative; given in inflammations, hæmorrhages, and in other cases, when it is necessary to diminish the too frequent action of the heart. Great care is requisite during its use, for it is apt to accumulate in the system, and its effects to come on suddenly, as if all the doses had been taken at once. The depression occasioned by it requires perfect rest, the horizontal posture, and the administration of cordials and stimulants.

Dose.—Gr. j. to gr. iij. of the powder, *m.* x, to ʒss. of the tincture, ʒij. to ℥ss. of the infusion.

Diosma.

The leaves of Diosma Crenata, Buchu, a native of Southern Africa. Cl. Pent.: O. Monog.: N. O. Diosmeæ.

Use.—Tonic and diuretic to the urinary organs; used in the same cases as Uva Ursi.

Dose.—Gr. x. to gr. xxx.

Dolichi Pubes.

Vide Mucuna.

Dulcamara.

The stalks of the Solanum Dulcamara, Bittersweet or Woody Nightshade. Indigenous. Cl. Pentandria: O. Monogy.: N. O. Solanaceæ.

Use.—Alterative and diuretic; given in dropsies, chronic rheumatism, and some skin diseases.

Dose.—℈j. to ʒj.

ELATERIUM.

Squirting Cucumbers, the fruit of the Momodica Elaterium, a native of the south of Europe. Cl. Monœcia; O. Monadelphia: N. O. Cucurbitaceæ. The extract is obtained by slicing the cucumbers and gently expressing the juice, which deposits a fæcula, and this is subsequently dried for use.

Use.—A powerful hydragogue cathartic, given principally in dropsies.

Dose.—Gr. ¼ to gr. j.

ELEMI.

Elemi, which is brought from Brazil and Carolina, exudes from incisions made in the bark of the Amyris Elemifera. Cl. Octand.: O. Monog.: N. O. Amyridaceæ. It chiefly consists of resin and volatile oil.

Use.—Stimulant, but principally applied externally.

Dose.—Gr. x. to ℈j.

ERGOTA.

Ergot of Rye, diseased grain of the Secale Cereale, produced by a fungus named Acinula Clavus. Cl. Triand.: O. Digy.: N. O. Graminaceæ.

Use.—A stimulant to the uterus in increasing its contractions, especially during labour. It has the power also of restraining hæmorrhages and other discharges.

Dose.—Gr. xx. to gr. xxx.

EUPHORBIUM.

Euphorbium is an exudation from the stem of the Euphorbia Officinalis, a native of Africa. Cl. Dodec.: O. Trigynia: N. O. Euphorbiaceæ.

Use.—Chiefly as an errhine, in lethargic cases and amaurosis. It has been used externally to increase the activity of blisters, but most commonly in veterinary medicine.

Dose.—A grain or two snuffed up the nose.

FARINA.

The flour of the seeds of Triticum Hybernum. Wheat.

Use.—It is employed medicinally in poultices and in some powders.

FERRI PERCYANIDUM.

Prussian Blue, now described as a Ferro-Sesquicyanuret of the Cyanuret of Iron, and is used in pharmacy to obtain the Bicyanide of Mercury. By itself it has no medical use.

FERRUM.

Iron Filings are introduced into the Pharmacopœia on account of being used in several preparations.

Use.—By some considered as tonic and anthelmintic.

Dose.—Gr. v. to 3j.

FICI.

Figs, the dried fruit of Ficus Carica. Cl. Polyg.: O Dicœcia: N. O. Urticaceæ.

Use.—Laxative and demulcent.

Dose.—Almost ad libitum.

FŒNICULUM.

The fruit of the Fœniculum Vulgare. Common Fennel. Indigenous. Cl. Pentandria: O. Digynia: N. O. Umbellatæ.

Use.—Carminative and diuretic.

Dose.—℈j to 3j. of the bruised seeds.

GALBANUM.

The Gum-Resin of the Bubon Galbanum, brought from Smyrna. Cl. Pent.: O. Digyn.: N. O. Umbellatæ.

Use.—Stimulant and antispasmodic; given in hysteria and chlorosis; externally rubefacient.

Dose.—Gr. v. to ℈j.

GALLÆ.

Gall-nuts are round excrescences found on the Quercus Infectoria, of Syria and Asia Minor. Cl. Monœcia: O. Polyand.: N. O. Corylaceæ. The gall-nuts are said to be formed in the short space of two days. A cynips, or little insect, punctures the leaves, and deposits its egg, which, acting as a foreign body, causes a substance

to be thrown out around it, which forms the nut. The best are of a greyish blue colour, and not perforated. They contain a large quantity of gallic acid and tannin.

Use.—Astringent, given in diarrhœa, and used as an injection, and as an external application in case of piles.

Dose.—Gr. v. to x.

GENTIANA.

The root of the Gentiana Lutea, a native of Switzerland. Cl. Pent.; O. Digynia; N. O. Gentianaceæ.

Use.—Tonic and stomachic; given in dyspeptic cases.

Dose.—Gr. x. to 3j.

GLYCYRRHIZA.

The fresh root of the Glycyrrhiza Glabra, a native of the south of Europe, but now abundantly cultivated in this country. Cl. Diadelp.; O. Decand.; N. O. Ligumenosæ.

Use.—Demulcent; given in coughs.

Dose.—Gr. x. to 3j.

GRANATUM.

The bark of the fruit and root of the Punica Granatum, a native of the south of Europe. Cl. Icos.; O. Monog.; N. O. Pomeæ.

Use.—Astringent and anthelmintic; given in dysentery and tænia; it may be used as a gargle, and as an injection in leucorrhœa, in relaxed state of the uvula, and velum pendulum palati.

Dose.—℈j. to 3j., as an astringent.

GUAIACI RESINA ET LIGNUM.

This resin exudes from incisions made in the bark of the Guaiacum Officinale, which grows in Jamaica. Cl. Dec.; O. Monog.; N. O. Zygophylleæ. Its green colour is owing to the absorption of oxygen.

Use.—Alterative, diaphoretic, and slightly purgative; given in chronic rheumatism, and some cutaneous affections.

Dose.—Gr. x. to 3ss.

HÆMATOXYLUM.

The wood of the Hæmatoxylon Campechianum, a tree growing in Campeachy, and in South America. Cl. Dec.; O. Monog.; N. O. Leguminosæ.

Use.—The extract obtained from the wood is astringent, and may be given in diarrhœa and dysentery.

Dose.—℈j. to 3j.

HELLEBORUS.

The root of the Helleborus Officinalis, or Black Hellebore, a native of Austria and Italy. Cl. Poly.; O. Polygynia; N. O. Ranunculaceæ.

Use.—Cathartic and emmenagogue, and recommended in mania and melancholy.

Dose.—Gr. v. to ℈j.

HORDEUM.

The decorticated seeds of the Hordeum Distichon. Cl. Triand.; O. Digy.; N. O. Graminaceæ.

Use.—Demulcent; given as a decoction.

Dose.—Ad libitum.

HYDRARGYRUM.

Mercury or Quicksilver is found in Spain, Friuli, the Palatinate, and in America. It is found either in the metallic state, or combined with sulphur, silver, copper, or chlorine. The greatest portion of the mercury of commerce is obtained from the sulphuret or cinnabar, which is subjected to an intense heat with lime, when the pure mercury is volatilized and condensed in a receiver.

Use.—Metallic Mercury has been recommended in ileus and hernia, but its internal use is at present abandoned.

HYOSCYAMI FOLIA ET SEMINA.

The leaves and seeds of the Hyoscyamus Niger, or Common Henbane. Indigenous. Cl. Pent.; O. Monog.; N. C. Solanaceæ.

Use.—Anodyne and narcotic, and slightly aperient; given in spasms, gout, and asthma, and in inflammatory diseases where opium would be injurious.

Dose.—Gr. v. to gr. xv.

JALAPA.

The root of the Ipomæa Jalapa, a native of North America. Cl. Pent.; O. Monog.; N. O. Convolvulaceæ.

Use.—Cathartic and hydragogue, given generally in combination with calomel, scammony, or bitartrate of potash, in dropsies and worm cases.

Dose.—Gr. x. to 3ss.

INULÆ RADIX.

The sliced root of the Inula Helenium, Elecampane. Indigenous. Cl. Syng.; O. Superfl.; N. O. Synantheraceæ. It contains a large quantity of a substance somewhat resembling starch, named inulin, a volatile aromatic principle, and with several other substances in small quantities.

Properties.—Tonic, stimulant, and diuretic.

Dose.—Gr. x. to 3ss.

IODINE.

An elementary substance found in sea-weed.

Use.—It is of service in scrofulous sores and tumours, syphilis in scrofulous habits, hydrocephalus, chronic hepatitis, dropsies in general, particularly ovarian. Seldom used in its simple form, more often in the shape of iodide of potassium.

Dose.—3j. to 3iij.

IPECACUANHA.

The root of the Cephaelis Ipecacuanha, a native of Brazil. Cl. Pent.; O. Monog.; N. O. Cinchonaceæ. It has an annulated appearance, which distinguishes it from another root, which is known as striated ipecacuanha, the Linnean name of which is Psychotria Emetica. It contains about 16 per cent. of its active principle, emetine.

Use.—Diaphoretic, expectorant, and emetic: particularly useful in pertussis, catarrh, pneumonia of children, and asthma; and may be given as a nauseant in most inflammatory fevers. It aids the action of purgatives, and in small doses is recommended in diarrhœa and dysentery.

Dose.—Gr. ¼. to gr. j. as an expectorant; gr. j. to gr. iij., as diaphoretic, gr. x. to 3ss. as an emetic.

Juniperi Fructus et Cacumina.

The tops and fruit of the Juniperus Communis. Indigenous. Cl. Diœcia; O. Monad.; N. O. Pinaceæ. They contain an essential oil, on which their properties depend.

Use.—Diuretic in dropsies.

Dose.—3ss. to 3j.

Kino.

The extract from the wood of the Pterocarpus Erinacea, which grows in Africa. Cl. Diadelph.; O. Dec.; N. O. Leguminosæ.

Use.—Astringent, given in diarrhœa, dysentery, hæmorrhages, and fluor albus. The astringent property is lost by combining alkalies with it.

Dose.—Gr. x. to 3ss.

Krameriæ Radix.

The root of the Krameria Triandra, brought from Peru. Cl. Tetrand.; O. Monog.; N. O. Polygalaceæ. It contains tannin uncombined with gallic acid.

Use.—Astringent and tonic; given in passive hæmorrhages, diarrhœa, leucorrhœa, and diabetes.

Dose.—Gr. xx. to 3ss.

Lacmus.

Litmus, the prepared Thallus of the Roccella Tinctoria, which grows in the Canary Islands.

Litmus is not used as a medicine, but as a colouring matter to detect the presence of acids, which turn it from a blue to a red colour.

Lactucarium.

The inspissated juice of the Garden Lettuce, Lactuca Sativa. Cl. Syng.; O. Æqualis; N. O. Syanth. It is obtained from the mature plant by cutting or breaking off the tops, and collecting the milky juice and drying it.

Use.—Narcotic and anodyne, recommended in phthisis.

Dose.—Gr. iij. to gr. x.

LAVANDULÆ FLORES.

The tops of the Lavandula Spica, a native of the south of Europe. Cl. Didyn.; O. Gymnosp; N. O. Labiatæ.

Use.—Stimulant and tonic; given in dyspepsia.

Dose.—Gr. v. to ℈j.

LAURI BACCÆ ET FOLIA.

The leaves and berries of the Laurus Nobilis, or Bay tree, a native of Italy. Cl. Enneand.; O. Monog.; N. O. Lauraceæ.

Use.—Stimulant and narcotic.

Dose.—Gr. v. to ℈j.

LIMONES.
LIMONUM CORTEX.
LIMONUM OLEUM.

The fruit of the Citrus Medica, a native of Spain, Italy, &c.

Use.—The juice is refrigerant in fevers, and useful in scurvy. The peel is tonic, and may be given in dyspepsia. The oil is merely used on account of its fragrance, as an adjunct to other medicines.

Dose.—Of the juice ad libitum, of the peel gr. x. to ℥ss.

LINI OLEUM ET SEMINA.

The seeds and oil of the Linum Usitatissimum, or Common Flax. Cl. Pent.; O. Pentag; N. O. Linaceæ.

Use.—Demulcent, given in infusion, in catarrh, gonorrhœa, &c. The powder is externally used in the form of a poultice.

Dose.—Ad libitum.

LOBELIA.

The entire plant of Lobelia Inflata, Indian Tobacco, a native of the United States. Cl. Pent.; O. Monog.; N. O. Lobeliaceæ.

Use.—Anodyne, narcotic and sedative; in larger but dangerous doses emetic and purgative. It acts much like tobacco.

Dose.—Gr. ss. to gr. iij.

LYTHRUM SALICARIA.

Loosestrife. Indigenous. Cl. Dodec.; O. Monog.; N. O. Salicariæ.

Prep. — This plant is astringent, and useful in diarrhœa.

Dose.—Gr. x. to 3j., or in decoction.

LUPULUS.

The dried strobiles of Humulus Lupulus, Common Hop. Cl. Diœcia; O. Pentandria; N. O. Urtecaciæ.

Use.—Anodyne, narcotic, tonic, and perhaps diuretic; given to gouty and dyspeptic patients.

Dose.—Gr. v. to gr. x. of the ext., 3j. to 3iij. of the tincture.

MAGNESIÆ CARBONAS.

Carbonate of Magnesia.

Use.—Antacid and laxative.

Dose.—3ss. to 3ij.

Prep.—Magnesia.

MAGNESIÆ SULPHAS.

Sulphate of Magnesia is obtained in several ways: First, by evaporating waters which hold it in solution, such as sea-water, &c. It is prepared in England by calcining limestone, which contains magnesia, by which a hydrate of lime and magnesia is formed; hydrochloric acid is then added in sufficient quantity to combine with the lime only, and the residue is washed and treated with sulphuric acid, which converts it into a sulphate.

Use.—Purgative and diuretic. Its action is aided by being largely diluted with water, and by combining with it a little tartar emetic, or dilute sulphuric acid. Exposure to cold air causes it to operate on the kidnies.

Dose.—℥ss. to ℥j.

MALVA.

The entire plant of the Malva Sylvestris, or common Mallow. Indigenous. Cl. Monad.; O. Polyand.; N. O. Malvaceæ.

Use.—Demulcent in strangury and dysentery.

Dose.—Ad libitum.

MANGANESII BINOXYDUM.

The binoxide or black oxide of Manganese; used in pharmacy to assist in the disengagement of chlorine.

MANNA.

An exudation from the branches of the Ornus Europæa, or Flowering Ash; a native of Sicily. Cl. Diand.; O. Monog.; N. O. Oleaceæ.

Use.—Gently laxative, only fit for children.

Dose.—3ij. to ℥j.

MARANTA.

The Fæcula of the Rhizome of Maranta Arundinacea, Arrow Root. Cl. Mon.; O. Monog.; N. O. Marantaceæ.

Use.—Nutritive and demulcent, fitted for weak and delicate stomachs.

MARMOR.

Marble, a pure carbonate of lime when perfectly white, used to obtain carbonic acid.

MARRUBIUM.

Marrubium Vulgare, or White Horehound. Indigenous. Cl. Didyn.; O. Gymnosp.; N. O. Labiatæ.

Use.—Tonic and diuretic; given in coughs, asthma, &c.

Dose.—℈j. to 3ss.

MASTICHE.

Mastich is the exudation from the trunk and branches of the Pistachia Lentiscus, a native of Spain and the Grecian Islands. Cl. Diœcia; O. Pent.; N. O. Anacardiaceæ.

Use.—Astringent and diuretic; given in gleets and leucorrhœa.

Dose.—Gr. x. to 3ss.

MENTHA PIPERITA.

Peppermint, Mentha Piperita. Indigenous. Cl. Didyn.; O. Gymnosp.; N. O. Labiatæ.

Use.—Carminative.

Dose.—Gr. x. to ℈j.

MENTHA PULEGIUM.

Pennyroyal. Indigenous.
Use.—As the former, but in addition is said to be expectorant and emmenagogue.

MENTHA VIRIDIS.

Spearmint.
Dose.—Doses and preparations as peppermint.

MENYANTHES.

The leaves of the Menyanthes Trifoliata or Buck-bean. Indigenous. Cl. Pent.; O. Monog.; N. O. Gentianaceæ.
Use.—Tonic and purgative; given in gout, rheumatism, and intermittents.
Dose.—3ss. to 3j., or in infusion.

MEZEREUM.

The bark of the root of Daphne Mezereum, a native of North Europe. Cl. Oct.; O. Monog.; N. O. Thymeleaceæ.
Use.—Diaphoretic and stimulant; given in chronic rheumatism and cutaneous diseases.
Dose.—Gr. ij. to gr. x.

MORA.

Mulberries, the fruit of the Morus Nigra, a native of Persia and Italy. Cl. Monœcia; O. Tetrand.; N. O. Urticaceæ.
Use. — Refrigerant and laxative, and give a fine colour to a syrup.

MOSCHUS.

Musk is found in a bag situated between the navel and prepuce of the Moschus Moschiferus, or Musk Deer, a native of Thibet, China, and Siberia.
Use.—Stimulant and antispasmodic; given in tetanus, hysteria, and epilepsy.
Dose.—Gr. v. to 3ss.

MUCUNA.

The hairs of the pods of Mucuna Pruriens. Cl. Diadel.; O. Dec.; N. O. Leguminosæ.

Use.—Mechanical anthelmintic; given in treacle or syrup.

Dose.—Gr. iij. to gr. v.

MYRISTICA ET OLEUM.

The nuts and oil of the Myristica Moschata, a native of the Moluccas. Cl. Diœcia; O. Monad.; N. O. Myristicaceæ.

Use.—Aromatic, stimulant, and narcotic; generally given as an adjunct to other medicines.

Dose.—Gr. v. to ℈j.; *m.* ij. to *m.* v. of the oil.

MYRRHA.

Myrrh is the Gum Resin of a plant growing in Arabia, named the Balsamodendron Myrrha. Cl. Octand.; O. Monog.; N. O. Burseraceæ.

Use.—Expectorant and tonic; given in catarrh and dyspepsia, and is often combined with preparations of iron and aloes.

Dose.—Gr. x. to ℥ss.

NUX VOMICA.

The seeds of the Strychnos Nux Vomica, a native of the East Indies. Cl. Pent.; O. Monog.; N. O. Strychnaceæ. The active principle of the Nux Vomica is strychnine, with a little brucine and strychnic acid. It acts as a stimulant, particularly to the nerves of the spinal cord. One pound of the seed contains about 34 grains of strychnine. It is excessively bitter, so that one grain will give a bitter taste to 80 pounds of water.

Use.—It is most serviceable in paraplegia, produced by sedatives, likewise in the paralysis from lead.

Dose.—Of strychnine gr. $\frac{1}{16}$ to gr. ij., gradually increased; the extract gr. ss. to gr. ij.; the powder gr. v. to ℈j.

OLIBANUM.

An exudation from the Boswellia Serrata, a native of India. Cl. Dec.; O. Monog.; N. O. Burseraceæ.

Use.—Stimulant and diuretic; seldom used but to scent sick rooms.

Dose.—Gr. v. to ℈j.

Olivæ Oleum.

The expressed oil of the drupes of the Olea Europea, native of the south of Europe. Cl. Diand.; O. Monog.; N. O. Oleaceæ.

Use.—Demulcent in the form of emulsion, in coughs and as an ingredient in ointments and cerates.

Dose.—3j. to 3ij.

Opium.

The concrete juice of the Papaver Somniferum, generally obtained by making incisions in the unripe capsules The kinds of opium commonly met with are the Turkey, Persian, Egyptian, and East Indian. The first has long had the preference. Cl. Polyand.; O. Monog.; N. O. Papaveraceæ.

Properties and Uses.—Opium acts variously in different doses; in small repeated doses it is a stimulant, diaphoretic, and narcotic; in doses of 2 or 3 grains it acts as a sedative. It locks up all secretions excepting that from the skin, producing clay-coloured evacuations. It is very serviceable in intermittent fevers, low typhus, diarrhœa, dysentery, pleuritis after bloodletting, bronchitis, ophthalmia, rheumatism, gout, chordee, during the passage of biliary and urinary calculi, small-pox, colic, &c. As a general rule, it is contra-indicated where there is a full and hard pulse, with dry tongue and skin, and with affection of the head.

Dose.—Gr. ss. to gr. iij.

Opoponax.

The inspissated juice, obtained by incisions in the roots of the Pastinaca Opoponax, or rough parsnip, a native of the south of Europe. Cl. Pent.; O. Digyn.; N. O. Umbellatæ.

Use.—Antispasmodic and emmenagogue, given in hysteria and amenorrhœa.

Dose.—Gr. x. to 3ss.

ORIGANUM.

The leaves of the Origanum Vulgare, or Common Marjoram. Indigenous. Cl. Didyn.; O. Gymnosp.; N. O. Labiatæ.

Use.—Tonic, stomachic, and carminative; given in debility of the stomach.

Dose.—Gr. v. to ℈j.

OVUM.

The egg of the common barn-door fowl.

Use.—A nutritive substance, and employed in pharmacy to suspend insoluble materials.

PAPAVERIS CAPSULÆ.

The ripe capsules of the Papaver Somniferum.

Use.—Anodyne in fomentations.

PAREIRA.

The root of Cissampilos Pareira, a native of Brazil. Cl. Diœcia; O. Monad.; N.O. Menispermaceæ.

Use.—A tonic to the urinary organs in cases of debility, or morbid secretion from the mucous membrane of the bladder or kidnies.

Dose.—Gr. x. to gr. xxx.

PETROLEUM.

Barbadoes tar, a natural product.

Use.—Antispasmodic; given in asthma, and as a vermifuge.

Dose.—Gr. x. to ℥ss.

PHOSPHORUS.

Used to obtain the dilute of Phosphoric Acid. *Vide* Decompositions.

PIMENTÆ BACCÆ.

Allspice; The dried unripe berries of the Myrtus

Pimenta of South America and the West Indies. Cl. Icosand.; O. Monog.; N. O. Myrtaceæ.

Use.—Tonic, stimulant, and aromatic.

Dose.—Gr. v. to ℈j.

PIPER CUBEBA.

Cubebs, the berries of Pip. Cubeba. Cl. Diand.; O. Trig.; N. O. Piperaceæ.

Use.—Stimulant and diuretic, given in atony of mucous membranes, gonorrhœa, and gleet.

Dose.—3j. to 3ij.

PIPER LONGUM.

The dried unripe fruit of the Piper Longum of Bengal.

Use.—Tonic and stimulant.

Dose.—Gr. v. to gr. x.

PIPER NIGRUM.

The berries of the Piper Nigrum of the East Indies.

Use and Dose.—As the Piper Longum.

PIX ABIETINA.

Burgundy Pitch; the resinous exudation from incisions made in the bark of the Pinus Abies, or Norway Spruce Fir.

Use.—Externally stimulant and rubefacient.

PIX LIQUIDA.
PIX NIGRA.

Both obtained from the Pinus Sylvestris, or Scotch Fir, by the application of heat. Pix Nigra is merely inspissated Pix Liquida.

Use.—Alterative in some skin diseases, and used externally in the same, in the form of ointment.

Dose.—Gr. v. to 3ss.

PLUMBI CARBONAS.

The carbonate of lead is made by placing sheet-lead, in coils, in pots containing vinegar, but not in contact

with the acid. The pots are then covered with moist straw, which ferments and keeps up a temperature of about 115. In a few weeks the lead is found converted into a carbonate on the surface.

PLUMBI OXYDUM (SEMIVITREUM.)

Litharge, a Protoxide of Lead, used in making plasters and ointment.

PORRUM.

The bulb of the Allium Porrum, or Leek. Cl. Hex.; O. Monog.; N. O. Liliaceæ.

Use.—Expectorant and anthelmintic; given in asthma, catarrh, and worm cases.

Dose.—3j. to ℥ss. of the juice.

POTASSÆ NITRAS.

Purified Nitrate of Potash. Nitre is found native in some parts of the world, and in considerable quantity on the surface of the ground in India, in South America, Egypt, and Spain. In France and Germany it is made in nitre beds, which are formed by layers of animal and vegetable substances, mixed with lime. Nitric acid is formed by decomposition of the animal and vegetable substances, and combines with the lime, forming a nitrate of lime, which is decomposed by subcarbonate of potash, thus producing nitrate of potash and carbonate of lime.

Use.—Refrigerant and diuretic; given in inflammations in general, but contraindicated in inflammation of the kidney.

Dose.—Gr. x. to 3ss.

POTASSÆ CARBONAS IMPURA.

Common potash, named Pearlash, is obtained by burning wood and different land vegetables to ashes, which are then digested in water; the solution is evaporated, and the residue is calcined. Potash is prepared in very large quantities in Russia, America, and Tuscany.

POTASSÆ BITARTRAS.

Purified bitartrate of potash, or Cream of Tartar, exists abundantly in grape-juice, and is more soluble in

water than in spirit. It is deposited in wine casks, in proportion as the vinous fermentation proceeds.

Use.—Diuretic and purgative; given in dropsies.

Dose.—3ss. to 3j. as a diuretic; ℥ss. as a purgative.

POTASSÆ CHLORAS.

The chlorate of potash is very little used in medicine. It is supposed to arterialize the blood, and rouse the system in typhoid fevers.

Dose.—Gr. x. to gr. xxx.

POTASSII FERRO-CYANIDUM.

A yellow salt, never given internally, but used in pharmacy in procuring dilute hydro-cyanic acid.

PRUNA.

The dried fruit of the Prunus Domestica, a native of Asia and Europe. Cl. Icosand.; O. Monog.; N. O. Amygdaleæ.

Use.—Laxative and nutrient.

Dose.—Ad libitum.

PTEROCARPUS.

The wood of the Pterocarpus Santalinus, a native of India. Cl. Diadelp.; O. Dec.; N. O. Leguminosæ.

Use.—Only as a colouring matter.

PYRETHRUM.

The root of the Anthemis Pyrethrum, a native of the Levant, Barbary, and Spain. Cl. Syng.; O. Superfl.; N. O. Synanth.

Use.—Stimulant and sialogogue; used in apoplexy and toothach.

Dose.—Gr. iv. to gr. x., to be chewed, to excite the flow of saliva.

QUASSIA.

The wood of the Quassia Excelsa, which grows in Jamaica. Cl. Decand.; O. Monog.; N. O. Simarubaceæ.

Use.—Tonic; given in intermittents and dyspepsia.

Dose.—Gr. v. to 3ss.

QUERCUS CORTEX.

The bark of the Quercus Pedunculata. Indigenous. Cl. Monœcia; O. Polyand.; N. O. Corylaceæ.

Use.—Astringent and tonic; given in diarrhœa and intermittents. It is used in decoction as an injection in leucorrhœa and uterine hæmorrhage, and as a topical application in prolapsus ani.

Dose.—Gr. x. to ʒss.

QUINA.

The alkaline base of Cinchona Cordifolia. Vide Decompositions.

RESINA.

Yellow Resin, the residue of the distillation of the Oleum Terebinthinæ, obtained from the Pinus Sylvestris, or Scotch Fir.

Use.—Externally stimulant; used in ointments and plasters.

RHAMNUS.

The berries of the Rhamnus Catharticus, or Purging Buckthorn. Cl. Pent.; O. Monog.; N. O. Rhamnaceæ.

Use.—Purgative; given in dropsies, and as an adjunct to senna draughts.

Dose.—ʒj. to ℥ij.

RHEUM.

The root of the Rheum Palmatum, a native of China and Tartary. Cl. Enneand.; O. Trigy.; N. O. Polygonaceæ.

Use.—Purgative; but, in small doses, stomachic and astringent. Rhubarb appears to act most on the muscular coat, producing rather solid evacuations.

Dose.—As a purgative, gr. x. to ʒss.

RHÆAS.

The petals of the Papaver Rhæas, or Red Poppy. Indigenous. Cl. Polyan.: O. Monog.: N. O. Papaveraceæ.

Use.—As a colouring matter.

Ricini Oleum.

The expressed oil of the seeds of the Ricinus Communis, or Palma Christi, a native of the East and West Indies. Cl. Monœcia: O. Monand.; N. O. Euphorbiaceæ.

Use.—Mildly cathartic. It is a useful purgative for children and parturient women, likewise as an enema for the ascarides. It is the best cathartic to counteract the effects of lead in painters.

Dose.—℥iv. to ℥jss.

Rosa Canina.

The pulp of the fruit of the Rosa Canina, or Dog Rose. Indigenous. Cl. Icosand.; O. Polygy.; N. O. Rosaceæ.

Use.—Cooling and laxative for children.

Dose.—Ad libitum.

Rosa Centifolia.

The petals of the Rosa Centifolia. It contains an oil which forms the Otto of Roses.

Use.—Said to be laxative.

Rosæ Gallicæ Petala.

The petals of the Rosa Gallica, or Red Rose.

Use.—Astringent; given in infusion as a vehicle for less pleasant medicines.

Rosmarinus.

The dried plant of the Rosemary. Indigneous. Cl. Diandria; O. Monog.; N. O. Labiatæ. It contains a volatile oil. The oil is chiefly from the flower.

Use.—Given as an emmenagogue in chlorosis; also as a diuretic.

Dose.—*M.* v. to *m.* xv.

Rumex.

Vide Acetosa.

RUTA.

The leaves of the Ruta Graveolens, or common Rue, a native of the south of Europe. Cl. Dec.; O. Monog.; N. O. Rutaceæ.

Use.—Tonic, emmenagogue, and stimulant; given in hysteria and colic.

Dose.—Gr. x. to 3ss.

SABADILLA.

The seeds of the Helonias Officinalis, used to procure the Alkaloid Veratria.

Vide Decomp.

SABINA.

The fresh dried tops of the Juniperus Sabina, or common Savine, a native of the south of Europe. Cl. Diœcia: O. Monad.; N. O. Pinaceæ.

Use.—Emmenagogue; given in amenorrhœa and chlorosis: principally used as an irritant to blistered surfaces.

Dose.—Gr. v. to gr. x.

SACCHARUM ET SACCHARI FÆX.

Sugar obtained from the Sugar Cane, Saccharum Officinarum, a native of the East and West Indies. Cl. Triand.: O. Digy.: N. O. Graminaceæ. The crude, impure sugar is named treacle.

Use.—To sweeten medicines.

SAGAPENUM.

Sagapenum is a gum-resin, the produce of an unknown plant, brought from Smyrna and Aleppo.

Use.—Antispasmodic and emmenagogue.

Dose.—Gr. x. to 3ss.

SAGO.

The fæcula from the pith of the Sagus Rumphii, a species of Palm.

Use.—Nutritive and demulcent.

SAMBUCUS.

Flowers of the Sambucus Nigra, or common Elder. Indigenous. Cl. Pentand.; O. Trigy.; N. O. Caprifoliaceæ.

Use.—Diaphoretic.

Prep.—Unguentum Sambuci.

SAPO DURUS.

Spanish Soap is made with olive oil and soda. The colour of Spanish soap is generally owing to the presence of some sulphate of iron, which gives the blue mottled appearance, but when exposed to the air, it turns of a brownish red.

Use.—Laxative and lithontriptic, often used to preserve the proper consistence of pills, and to render them more soluble in the stomach.

Dose.—Gr. v. to 3ss.

SAPO MOLLIS.

Soft Soap is made with olive oil and potash.

SARZA.

The root of the Smilax Officinalis, a native of South America. Cl. Diœcia; O. Hexand.; N. O. Smilaceæ.

Use.—Alterative, demulcent, and diuretic; given in secondary syphilis and cutaneous diseases.

Dose.—℈j. to 3j.

SASSAFRAS.

The chips and bark of the root of the Laurus Sassafras, a native of China and North America. Cl. Ennean.; O. Monog.; N. O. Lauraceæ.

Use.—Stimulant and sodorific.

Dose.—℈j. to 3j.

SCAMMONIUM.

Scammony: the concrete juice, a gum-resin, is obtained by making incisions in the root of the Convolvulus Scammonea of Aleppo and Smyrna. Cl. Pent. O. Monog.; N. O. Convolvulaceæ. This drug is almost invariably adulterated with some chalk and flour.

Use.—Drastic purgative, and anthelmintic. As a purgative it acts briskly, causing also a copious discharge of mucus.

Dose.—Gr. v. to ℈j.

SCILLA.

The recent bulb of the Scilla Maritima, brought from the coast of Spain and the Levant. Cl. Hexand.; O. Monog.; N. O. Liliaceæ.

Use.—Expectorant and diuretic; given in dropsies, catarrh with chronic inflammation, and asthma. Its diuretic properties are much enhanced by combination with calomel.

Dose.—Gr. j. to gr. v.

SCOPARIUS.

The fresh tops of the Cytisus Scoparius, common Broom. Cl. Diadelph.; O. Decand.; N. O. Leguminosæ.

Use.—Diuretic, chiefly employed in dropsies.

Dose.—℥j. to ℥ij., in decoction.

SENEGA.

The root of the Polygala Senega, a native of North America. Cl. Diad.; O. Octand.; N. O. Polygalaceæ.

Use.—Tonic and expectorant; useful in typhus. It is also said to be an excellent emmenagogue.

Dose.—Of the powder gr. v. to gr. xv., of the decoction ℥vj. to ℥j.

SENNA.

The leaves of the Cassia Lanceolata and Obovata, brought from Alexandria. Cl. Dec.; O. Monog.; N. O. Leguminosæ.

Use.—Senna is a useful purgative in most cases requiring alvine evacuations. The infusion should be made with tepid water, which does not take up its griping principle, and it should be used recently prepared. Its activity is increased by Camphor mixture and guaiacum, and its griping is in a great measure corrected by ginger, or some neutral salt, as sulphate of magnesia.

Dose.—℈j. to ℥j.

SERPENTARIA.

The root of the Aristolochia Serpentaria, or Virginian Snakeroot. Cl. Gynand.; O. Hex.; N. O. Aristolochiaceæ.

Use.—Tonic, stimulant, and diaphoretic; given chiefly in typhoid fevers.

Dose.—Gr. x. to 3ss.

SEVUM.

Suet, the fat of the ovis aries, used in ointments.

SIMARUBA.

The bark of the Simaruba Officinalis of South America. Cl. Dec.; O. Monog.; N. O. Simarubaceæ.

Use.—Tonic; given in intermittents, chronic diarrhœa, and dyspepsia.

Dose.—Gr. x. to 3ss.

SINAPIS SEMINA.

The seeds of the Sinapis Nigra. Indigenous. Cl. Tetradyn.; O. Siliquosa; N. O. Brassicaceæ.

The seeds of this plant contain sulphate and phosphate of lime, likewise a little sulphur and nitrogen.

Use.—Stimulant, rubefacient, and emetic; given in dyspepsia, and often applied as a cataplasm.

Dose.—℈j. to 3ss.

SODII CHLORIDUM.

Common Salt is obtained either from salt mines, sea water, or saline springs, by evaporation.

Use.—Tonic and laxative.

Dose.—℈j. to 3j.

SODA IMPURA.

Soda may be obtained by the combustion of marine plants, such as Salsola Soda, and the residue be dissolved and subjected to several chemical processes, in order to separate the impurities. It is procured in great abundance in Spain.

Sodæ Phosphas.

Phosphate of Soda is a mild saline purgative, and has the advantage of not having a very disagreeable taste.
Dose.—3iv. to ℥j.

Spigelia.

The root of the Spigelia Marilandica of North America. Cl. Pent.; O. Monog.; N. O. Spigeliaceæ.
Use.—Anthelmintic; given in cases of lumbrici.
Dose.—Gr. x. to 3j.

Spiritus Rectificatus.

Spirits of Wine. Sp. gr. 838.

Spiritus Tenuior.

Proof Spirit. Sp. gr. 920.

Spiritus vini Gallici.

Brandy; has about the same strength as proof spirits.

Stannum.

Stanni Limatura: Tin Filings.
Use.—A mechanical anthelmintic, given for lumbrici and ascarides.
Dose.—Gr. xx. to 3j.

Staphisagria.

The seeds of the Delphinium Staphisagria, a native of the south of Europe. Cl. Polyand.; O. Trig.; N. O. Ranunculaceæ.
Use.—Cathartic; very rarely used: chiefly applied as a powder to destroy pediculi.
Dose.—Gr. iij. to gr. x.

Stramonii, Semina et Folia.

The seeds and leaves of the Datura Stramonium, brought from America. Cl. Pent.; O. Monog.; N. O. Solanaceæ.

Use.— Narcotic; given in mania, epilepsy, and asthma. The dried plant is sometimes cut into small pieces, and smoked like tobacco, in spasmodic asthma.

Dose.—Gr. ss. to gr. ij. of the extract.

STYRAX.

The balsam of the Styrax Officinale, brought from the south of Europe and the Levant. Cl. Dec.; O. Monog.; N. O. Styraceæ.

Use.—Stimulant and expectorant; given in asthma.

Dose.—Gr. x. to ʒss.

SUCCINUM.

Amber, a substance supposed to be of vegetable origin. By heat it yields an oil.

Use.—Stimulant.

SULPHUR.

Sulphur is found native in many parts of the world, particularly in the neighbourhood of volcanoes. It is also found combined with many metals, from which it may be obtained by exposure to heat.

Use.—It is a mild laxative; and is used in the form of ointment in the cure of the itch.

TABACUM.

Leaves of the Nicotiana Tabacum, a native of North America. Cl. Pent.; O. Monog.; N. C. Solanaceæ.

Use.— Narcotic, emetic, sedative, and cathartic; rarely given internally: principally used as an enema in hernia.

Dose.—Gr. ss. to gr. ij.; of the infusion ʒiv. to ʒvj. may be injected.

TAMARINDUS.

The fruit of the Tamarindus Indicus, from the East and West Indies. Cl. Monad.; O. Triand.; N. O. Leguminosæ.

Use.—Gently laxative.

Dose.—Ad libitum.

TARAXACUM.

The root of the Leontodon Taraxacum, or Dandelion. Indigenous. Cl. Syng.; O. Æqualis; N. O. Synanth.

Use.—Diuretic; useful in dropsies and jaundice.

Dose.—3ss. to 3ij.

Prep.—Ext. Taraxaci.

TEREBINTHINA CANADENSIS.

Canada Turpentine or Balsam, obtained from the Pinus Balsamea.

TEREBINTHINA CHIA.

The resin of the Pistacia Terebinthus.

TEREBINTHINA VULGARIS.

The resin of the Pinus Sylvestris, or Scotch Fir.

Use.—Stimulant and diuretic; in gleets and leucorrhœa.

Dose.—ʒj. to 3j.

TEREBINTHINÆ OLEUM.

Oil of turpentine; obtained by distillation from the raw turpentine of the Pinus Sylvestris.

Use.—Diuretic, purgative, and anthelmintic; given in tænia.

Dose.—3ss. to 3j. as a diuretic; as a purgative and anthelmintic, from ℥ss. to ℥iss. should be given, that it may run off by the bowels, without being absorbed and carried to the kidneys.

TESTÆ.

The shells of the Ostrea Edulis, or Oyster. Used as an antacid.

TIGLII OLEUM.

The expressed oil of the seeds of the Croton Tiglium, a native of the East Indies. Cl. Monœcia; O. Monad.; N. O. Euphorbiaceæ.

Use.—Drastic purgative; useful in mania, apoplexy, and tetanus.

Dose.—*M.* j. to *m.* iij.

TORMENTILLA.

The root of the Potentilla Tormentilla, or Septfoil. Indigenous. Cl. Icosandria; O. Polyg.; N. O. Rosaceæ.

Use.—Astringent; in diarrhœa.

Dose.—Gr. x. to 3ss.

TOXICODENDRON.

The leaves of the Rhus Toxicodendron, or Sumach of North America. Cl. Pent.; O. Trig.; N. O. Anacadiaceæ.

Use.—Stimulant and narcotic.

Dose.—Gr. ij. to gr. vj.

TRAGACANTHA.

Tragacanth, a natural exudation from the Astragalus Verus, a native of North Persia. Cl. Diadelp.; O. Dec.; N. O. Leguminosæ.

Use.—Demulcent; given in coughs.

Dose.—Gr. x. to 3ss.

TUSSILAGO.

The plant of the Tussilago Farfara. Indigenous. Cl. Syng.; O. Superfl.; N. O. Synantheraceæ.

Use.—Demulcent and expectorant; useful in coughs, asthma, and phthisis.

Dose.—3ss. to 3j.

VALERIANA.

The root of the Valeriana Officinalis, or Wild Valerian. Indigenous. Cl. Triandria; O. Monog.; N. O. Valerianiaceæ.

Use.—Antispasmodic and tonic; recommended in hysteria and epilepsy.

Dose.—℈j. to ℈ij.

Prep.—Tinct. Valerianæ Ammoniata.

VERATRUM.

Root of the Veratrum Album, or White Hellebore, a native of Greece and Italy. Cl. Polyg.; O. Monœcia; N. O. Melanthaceæ.

Use.—Errhine in amaurosis; emetic and purgative.

Dose.—Gr. ij. to gr. v. snuffed up the nose.

ULMUS.

The bark of the Ulmus Campestris, or Common Elm. Indigenous. Cl. Pent.; O. Digynia; N. O. Ulmaceæ.

Use.—Tonic and alterative; in intermittents and cutaneous diseases.

Dose.—℈j. to 3j.

UVA.

Raisins; the fruit of the Vitis Vinifera, a native of the south of Europe. Cl. Pent.; O. Monog.; N. O. Vitaceæ.

Use.—Demulcent, nutrient, and aperient.

Dose.—Ad libitum.

UVA URSI.

The leaves of the Arctostaphylos, Uva Ursi, or Bearberry. Indigenous. Cl. Dec.; O. Monog.; N. O. Ericaceæ.

Use.—It exerts a tonic and astringent action on the mucous membrane of the urinary passages. Hence, it is serviceable in hæmorrhage from the bladder, and that morbidly excited state of it, named cysterrhœa. It contains a large quantity of gallic acid and tannin.

Dose.—℈j. to 3ss. in powder, or two ounces of the decoction.

ZINCUM.

Zinc; only used to make the sulphate and oxide.

ZINGIBER.

The rhizome of Zingiber Officinalis of Jamaica. Cl. Monand.; O. Monogynia; N. O. Zingiberaceæ.

Use.—Stomachic and stimulant.

Dose.—Gr. v. to 3ss.

TABLE,

Showing the Proportion in which Opium, and certain Preparations of Antimony, Arsenic, and Mercury, are contained in some Compounds.

OPIUM.

Confectio Opii. Thirty-six grains contain one grain of opium.

Pil. Saponis comp. and *Pil. Styracis comp.* Five grains contain one grain of opium.

Pulvis Cornu Usti cum Opio. Ten grains contain one grain of opium.

Pulvis Cretæ compositus cum Opio. Two scruples contain one grain of opium.

Pulvis Ipecacuanhæ compositus. Ten grains contain one grain of opium.

Pulvis Kino compositus. One scruple contains one grain of opium.

Tinctura Opii. Nineteen minims contain about one grain of opium.

Tinctura Camphoræ composita. Four fluid drachms contain nearly one grain of opium.

ANTIMONY.

Vin. Ant. Potassio-tartratis. One fluid ounce contains two grains of tartarized antimony.

MERCURY.

Hydrargyrum cum Cretâ. Three grains contain one grain of mercury.

Liquor Hydrargyri Bichloridi. An ounce contains half a grain of the bichloride of mercury.

Linimentum Hydrargyri. Six drachms contain one drachm of mercury.

Pilula Hydrargyri. Three grains contain one grain of mercury.

Pilula Hydrargyri Chloridi composita. Four grains contain about one grain of the chloride of mercury.

Unguentum Hydrargyri Fortius. Two drachms contain one drachm of mercury.

Unguentum Hydrargyri Mitius. Six drachms contain one drachm of mercury.

ARSENIC.

Liquor Potassæ Arsenitis. Two fluid drachms contain one grain of the arsenious acid.

ANATOMY.

BRIEF DESCRIPTION OF THE VISCERA, &c.

THE viscera of the body are parts contained in cavities, highly vascular, and destined for the support of animal life.

They are the contents of the *cranium*, *thorax*, *abdomen*, and *pelvis*.

The cranium is formed by eight bones, six proper, and two common to it and the face. The six proper are the *os frontis*, *os occipitis*, *two ossa parietalia*, and *two ossa temporum;* the two common are the *os ethmoides* and *os sphenoides*.

The bones of the head are classed amongst flat bones. They consist of two tables, the external and internal, with a cancellous structure between them, named *diploe*. The inner table is most easily broken, and is called the tabula vitrea.

These bones are connected by sutures, which are the coronal, sagittal, lambdoidal, and two squamous, with an additamentum suturæ squamosæ and lambdoidali. They are a consequence of the separate formation of the bones, and are of use in preventing the extension of fractures.

The contents of the cranial cavity are, the *brain*, with its *vessels*, *membranes*, and *nerves*.

The membranes are three in number: the *dura mater*, *tunica arachnoidea*, and *pia mater*.

The *dura mater* is a very strong, dense, fibrous membrane, of a white pearly appearance, rough externally, smooth internally. It lines the cranium, and forms its internal periosteum; it also extends down the spinal column in the form of a sheath to the spinal cord, but does not become the periosteum as in the cranium, being separated from the bones by veins, serous fluid, fat, and cellular tissue.

Its fibres run in different directions: those on the outside are longitudinal, those on the inside circular; and, besides these, there are oblique fibres, which take various courses.

The outer surface is rendered rough by a separation of the vessels, which pass from the membranes to the bones for their nutrition. On the outer surface of this membrane, near the mesial line of the vertex, are seen some granular bodies, called the external Pacchionian glands. Their use is not known.

The inner surface is smooth, and united firmly to a layer of the arachnoid membrane, which indeed may be said to produce the polished smooth appearance.

The arteries of the dura mater, named meningeal, are anteriorly from the ophthalmic; in the centre, from the internal maxillary; and posteriorly, from the vertebral, occipital, and ascending pharyngeal.

Its veins empty themselves into the neighbouring sinuses. The dura mater serves as a channel

for the passage of the nerves from the cranium, and gives an investment to many of them at their exit.

It is divisible into two layers, of which the external one is the thickest. By their separation in certain parts spaces are left, called sinuses; and by a folding of the internal portion, are formed the falx major, falx minor, and tentorium.

The *falx cerebri*, or *major*, extends from the crista galli, following the course of the sagittal suture, to the internal occipital protuberance at the back part of the skull, where it unites with the tentorium. It divides the cerebrum into two portions, called hemispheres. It protects either hemisphere from the pressure of the other, in lateral positions of the head.

The *tentorium* extends across the back part of the cranium, between the cerebrum and the cerebellum, and protects the latter from the pressure of the former.

The *falx cerebelli* extends from the tentorium to the foramen magnum, along the spine of the occipital bone, to the margin of the foramen magnum.

The sinuses in the dura mater or venous reservoirs of the brain, are the *superior* and *inferior longitudinal;* the *right* and *left lateral;* the *straight sinus;* the *torcular Herophili; anterior* and *posterior transverse sinuses*, and the *circular sinus of Ridley;* and on each side, the *superior* and *inferior petrosal;* the *cavernous* and the *occipital.* They are lined with a delicate membrane of the same character as that of the vessels with which they communicate.

The *superior longitudinal* is triangular in shape,

commencing at the foramen cæcum, and extending to the Torcular Herophili, where it may be said to terminate in the lateral sinuses; within it, we find the middle Pacchionian glands, ribbon-shaped Chordæ Willisii, and the openings of the veins from behind forwards.

The *inferior longitudinal* is in the inferior portion of the falx major; posteriorly it unites with the vena Galeni, and forms the *straight sinus*, which runs along the middle of the tentorium to the Torcular Herophili.

The *Torcular Herophili* is a conflux of sinuses opposite the centre of the crucial spine, with about six openings in it, viz., one from the superior longitudinal, one from the straight, two into the lateral, and one or two from the occipital sinus or sinuses.

The *lateral sinuses* carry out the blood from the brain, by the foramina lacera posteriora, and in that situation become the internal jugular veins. The right one is generally the larger.

The *transverse sinuses* run along the anterior and posterior walls of the Pituitary Fossa; and by connecting the two cavernous sinuses, they form conjointly, the *Circular Sinus of Ridley.* There is a third transverse sinus below and behind the posterior Clinoid processes, which connects the inferior petrosal sinuses.

The *superior petrosal* is small, and lies upon the superior angle of the petrous bone; it leads from the cavernous and pours its blood into the lateral sinus.

The *inferior petrosal* is a continuation of the cavernous sinus: it rests upon the contiguous borders of the petrous and occipital bone, groov-

ing them, and pours its blood into the lateral sinus.

The *occipital sinuses* are small and irregular, sometimes wanting; they pass from the edge of the foramen magnum, along the attached margin of the falx minor, into the Torcular Herophili; sometimes they communicate with the lateral sinuses, near the anterior margin of the foramen magnus.

The *cavernous sinus* of each side is situated on the side of the body of the Sphenoid bone. Anteriorly it receives the ophthalmic vein, conveying most of the blood from the orbit; posteriorly it leads to the petrosal sinuses, and internally unites with the transverse sinuses. It is formed by a separation of the layers of the dura mater; the lower and internal one, resting on the bones, is thin; the upper one is much thicker, and extends from the clinoid processes to the petrous bone; contains within its fibres or laminæ the third, fourth, and first division of the fifth nerve.

The intermediate space is lined by a delicate membrane, continuous with the inner coat of the ophthalmic vein, and this is reflected over the parts which traverse the sinus, so that they are not in immediate contact with the blood; the parts passing through are the carotid artery, with filaments of nerves, forming the Carotic Plexus, and, on the outer side of the artery, the sixth pair of nerves. There are, besides, numerous tendinous fibres stretched across, which give it an intricate cellular appearance.

Under the dura mater, and resting on the pia mater, is the *tunica arachnoides*. It is a delicate, smooth, transparent, serous membrane, forming a

shut sac, reflected over the cerebral mass, spinal cord, and nerves, as far as their exit from the cranium and spinal sheath, and lining the dura mater.

It is adherent to the pia mater in every part, except between the tuber annulare and conjoint optic nerves, and also between the medulla oblongata and cerebellum, and in the anfractuosities of the brain, where it is covered by the pia mater only. Under the velum it surrounds the vena galeni, traverses the fissure of Bichat, and passes into the third, and thence into the lateral and fourth ventricles, forming their lining membrane.

Immediately under, and closely connected with, the arachnoid membrane, is the *pia mater*. It appears to be an expansion of cellular tissue, to admit of, and conduct the ramifications of the vessels. It immediately covers the brain, and also dips down between the convolutions: processes of it enter the lateral ventricles, forming the choroid plexuses: a continuation of these under the fornix is named tela choroidea, or velum interpositum; there is also a little process of it protruded into the fourth ventricle. It passes down upon the spinal cord, but becomes thicker, more lamellated, and of a paler colour, and less vascular. Cloquet considers that it is not the same membrane, but without sufficient reason. That of the cranium is perfectly continuous with the one upon the spinal cord, and differs, probably, on account of the part to which it is applied. Unlike the arachnoid, it is extended upon the nerves, which quit the cranium and spinal column, and chiefly forms their neurilema.

In addition to the three membranes just de-

scribed as common to the brain and spinal cord, there is a fourth membranous structure, peculiar to the spinal marrow, viz., the *Ligamentum Denticulatum.* It is a delicate transparent membrane, presenting a number of triangular portions, placed between the anterior and posterior spinal nerves, attached by their apex to the inner surface of the dura mater, by their base to the pia mater; their use and precise structure are not known. Some consider them to be formed by arachnoid, others that they are of a distinct cellular nature.

CEREBRO-SPINAL SYSTEM.

The cerebro-spinal system is composed of four substances, differing in their colour.

The white or *medullary substance* constitutes the inner part of the cerebrum and cerebellum, but is placed externally in the pons varolii, crura cerebri and cerebelli, the medulla oblongata, and medulla spinalis. It has a fibrous structure, and appears to consist of minute globules united together in a linear manner.

The grey or *cineritious substance,* forms the outer layer of the cerebrum and cerebellum, and is found in the centre of the pons varolii, crura cerebri and cerebelli, the medulla oblongata, and medulla spinalis. Its colour is owing to its numerous minute blood-vessels ; its globules are not arranged in lines so as to give the appearance of fibres.

The yellow substance is a modification of the grey, and may be seen between the grey and white in the lower part of the posterior cerebral lobes, and in the cerebellum.

The black substance is seen in the crura cerebri, of a semilunar form, called locus niger.

THE BRAIN.

The brain, as it is ordinarily denominated, consists of the *cerebrum, cerebellum,* and *medulla oblongata.*

The *cerebrum* occupies the upper and larger portion of the cranium. It is divided by the falx major into two *hemispheres;* and each hemisphere is divided into three lobes, the anterior, middle, and posterior; the two former are separated, inferiorly, by a depression, named *fissura Sylvii;* between the middle and posterior lobe there is no distinct line of demarcation.

The *anterior* lobe rests on the orbitar plate of the frontal bone, the alæ minores of the Sphenoid, and on the Ethmoid.

The *middle* lobe rests upon the alæ majores of the Sphenoid, and on the temporal bone, which parts form the middle fossa of the cranium.

The *posterior* lobe rests on the Tentorium.

On the surface of each hemisphere are seen convex ridges running in various directions, named gyri, or convolutions; the fissures between them are named sulci; the surface is adherent to the pia mater by cellular tissue and vessels, to which Ruysch has given the name of *tomentum cerebri.*

On gently separating the hemispheres of the cerebrum superiorly, the *corpus callosum* or commissura magna cerebri is brought into view. It is a white medullary substance, about three inches in length, extending transversely and horizontally from the inside of each hemisphere. Its upper surface is convex; a furrow, called raphè, runs along its centre, on the side of which are elevated ridges, and external to them, transverse lines, named *lineæ transversæ.* The anterior cerebral arteries run upon it, and are here named arteries of the corpus callosum.

The corpus callosum is reflected downwards anteriorly, forming a rounded margin, and ex-

tends to the base of the brain, to become continuous with the under surface of the corpus striatum; it passes over the optic commissure, with which it is slightly blended, and is lost in the Tuber Cinereum and substantia perforata antica; posteriorly it terminates by a defined rounded margin, continuous with the fornix.

After slicing away the substance of either hemisphere to a level with the corpus callosum, a medullary portion is left, of an oval form, called *centrum ovale minus*; the two, similarly sliced off, form the *centrum ovale majus.*

The descending cornu takes a direction first backwards, outwards, and downwards, afterwards forwards and inwards, towards the base of the brain, at the inner edge of the fissure of Sylvius.

The parts noticed in it are the projecting white matter, named hippocampus major, which, inferiorly, forms four or five eminences, named the pes ihppocampi; a thin ribbon-shaped margin anteriorly, named tænia hippocampi; and parts of the choroid plexus.

The hippocampus major is continuous with the corpus callosum; the tænia hippocampi is a prolongation of the posterior pillars of the fornix. Upon the posterior descending portion of the hippocampus major, is a small rounded eminence, named *Pes accessorius;* and at the lower part of the tænia hippocampi, there is a narrow portion of grey matter, which, from its border being notched transversely, produces an appearance which has obtained for it the name of *fascia dentata.*

The *Corpora Striata* are grey, pyriform bodies, with the broad part converging anteriorly; wide apart from each other posteriorly. Internally they

consist of a mixture of white and grey matter, so arranged as to have given the name. The white matter is a prolongation of the anterior pyramids, which, in this part, are supposed to acquire an addition of matter, and these bodies are consequently called ganglia of increase, or superior cerebral ganglia.

Posterior to, and somewhat between the corpora striata, are situated the *Thalami Optici.* They are white convex bodies, partially connected together internally by some grey matter, named *commissura mollis*; on their posterior surface, are two small convex eminences, named *corpus geniculatum internum* and *externum.* They are continuous with the corpora quadrigemina, and from the external one the optic nerve appears to take an origin.

The thin band of white substance seen between the thalamus and corpus striatum, is the *tænia semicircularis.* The choroid plexus generally rests upon it.

The lateral ventricles are separated from each other by a thin partition, named *septum lucidum*, attached above to the corpus callosum, and below to the fornix; it is composed of two medullary layers externally, and two cineritious layers internally, between which is a cavity named the fifth ventricle. This partition, deep anteriorly, merges to a point posteriorly, where the corpus callosum and fornix unite.

Attached to the inferior edge of the septum lucidum is the fornix. The *fornix* consists of two anterior crura, the body, and the descending or posterior crura. The anterior crura, or pillars, may be traced down to the corpora albicantia.

The body of the fornix is somewhat triangular, with the broadest part posteriorly. The posterior crura terminate in, or are continuous with the hippocampi majores.

The anterior thin edge of the posterior crura extends into the descending cornu of the lateral ventricles, and is named *corpus fimbriatum*, or *tænia hippocampi.*

The under surface of the body of the fornix is marked with longitudinal lines, forming what is called *psalterium* or *lyra.*

There is an opening from each lateral ventricle to the third; it is between the anterior pillars of the fornix and optic thalami, and is named the *foramen of Monro*, or *foramen commune anterius:* through it passes the choroid plexus.

The *choroid plexuses* of the lateral ventricles are vascular, plexiform, membranous bodies, extending from the foramina of Monro over the thalami optici, to the termination of the ventricles. The veins of each plexus unite, and form the *vena Galeni*, which empties itself into the straight sinus. Sometimes there are two venæ Galeni.

Beneath the fornix is situated the *velum interpositum*, or tela choroidea, forming the roof of the third ventricle, extending from the surface of one thalamus opticus to the other, and continuous with the choroid plexuses.

Beneath the velum, is situated the *pineal gland*, connected to the thalami by two peduncles; and inferiorly to it, the *corpora quadrigemina.*

The *pineal gland* is a small heart-shaped body, with its base anterior. It rests on the groove between the nates, and is attached by two pillars or peduncles to the thalami optici. It contains a

little gritty matter within it, composed of phosphate of lime. It is also named *Conarium*, and *acervulus cerebri;* and was absurdly imagined by Descartes to be the seat of the soul.

The two highest eminences of the corpora quadrigemina are called *nates;* the posterior inferior are named *testes*. They are connected in front with the thalami, behind to the valve of Vieussens, and processus a cerebello ad testes.

There is a little fissure between their upper surface and the corpus callosum, called the *fissure of Bichat*, which admits the passage of the arachnoid membrane into the ventricles.

The *third ventricle* is a deep fissure, bounded laterally by the thalami optici; superiorly, by the velum and fornix; inferiorly, by the pons tarini, corpora albicantia, and tuber cinereum; anteriorly, by the anterior commissure and anterior crura of the fornix; and posteriorly, by the posterior commissure and corpora quadrigemina.

The *anterior commissure* is a medullary band, uniting the corpora striata, in front of the anterior crura of the fornix.

The *posterior commissure* is situated at the back part, and under the base of the pineal gland.

It receives anteriorly the foramina of Monro, or passage leading to the fourth ventricle.

The posterior termination is called *foramen commune posterius*, Iter a tertio ad quartum Ventriculum, Canalis Medius, or Aquæductus Sylvii.

There is an opening, leading downwards and forwards, from the foramen commune anterius to the infundibulum, called *iter ad infundibulum.*

The *infundibulum* is a conical body of cineritious and medullary substance, extending from

the tuber cinereum and anterior and inferior part of the third ventricle to the pituitary gland.

The pituitary gland is of an oval form, and of a brownish colour externally. It is situated in the sella turcica of the sphenoid bone.

Parts seen at the base of the Brain, proceeding from the front to the back part.

Looking down the separation of the anterior cerebral lobes, in the mesian line, we first see the anterior extremity of the corpus callosum.

On each side of the mesian line two whitish cords are seen lying in a groove of the anterior lobe; these are the olfactory nerves, with their anterior extremity enlarged, and of a greyish colour.

Laterally, the middle cerebral lobes are observed making an evident projection above the anterior lobes, from which they are separated by the fissure of Sylvius.

Further back, towards the middle line, are seen the optic nerves, separated anteriorly, united in the mesian line, and again diverging posteriorly. They may be traced over the crura cerebri to their origin in the thalami optici and tubercula quadrigemina.

Between the converging optic nerves, and internal convolution of the middle lobe, an angle is formed, in which part the pia mater enters the lateral sinus to form the choroid plexus. The angular part of the anterior lobe is called the *substantia perforata antica.* It is placed between the optic commissure, the inner termination of the fissure of Sylvius, and the longitudinal fissure.

Immediately behind the conjoint optic nerves, is a small grey process, called infundibulum, which is a hollow tube, leading from the third ventricle to the pituitary gland.

The base of the infundibulum is implanted on a grey eminence, called tuber cinereum, which forms part of the floor of the third ventricle, and is attached to the inner edge of the optic nerves.

Behind this are two little white bodies, called corpora albicantia, in which the anterior pillars of the fornix terminate. Internally they consist of grey matter.

Behind the corpora albicantia are two large bands of medullary matter, the crura cerebri. They have a greyish black substance in their centre, called locus niger.

Between the crura cerebri and the corpora albicantia there is a triangular space called pons tarini, or locus perforatus, which also assists in forming the floor of the third ventricle.

On the inner edge of the crura cerebri and on the locus perforatus the fibres of the third pair of nerves are seen given off. They may be traced as far as the locus niger.

Behind the crura cerebri, and continuous with them, is seen a quadrilateral white eminence, called the pons varolii, continuous behind with the crura cerebelli. Its upper part is covered by the tubercula quadrigemina, which form the upper wall of the aqueduct of Sylvius. Along its centre is seen a depression, occasioned by the passage of the basilar artery. It is said to be formed by the converging fibres of the cerebellum, and of which it is called the great commissure.

Along the external edge of the pons varolii is seen the fourth pair of nerves, which wind round the pons backwards and upwards towards the cerebellum, and may be traced to the valve of Vieussens.

From the middle of the outer edge of the pons varolii, the fifth pair of nerves is seen emerging in two bundles; the posterior largest, the anterior smallest.

At the posterior edge of the pons varolii, at about two or three lines from the mesian line, is seen the commencement of the sixth pair of nerves.

The posterior angles of the pons are continued obliquely outwards, forming the crura cerebelli; their upper part is continuous with the processus a cerebello ad testes, and their posterior portion with the corpora restiformia.

Behind the pons varolii is the medulla oblongata, separated from it by a deep depression, called foramen cæcum. It is thickest in front, smaller behind and downwards, and imperceptibly joins with the medulla spinalis. It is separated in the mesian line into two equal halves, each of which presents three eminences or cords.

The eminences on each side of the mesian line are the corpora pyramidalia. Their fibres interlace and are blended together behind, and in front are continued across the pons varolii.

On the outside of the corpora pyramidalia are the eminences called corpora olivaria. Their fibres take a course above the pons varolii, and their centre is of a greyish colour, which portion is named corpus dentatum olivare.

On the posterior and superior surface of the medulla oblongata, and at the sides of the corpora olivaria, are two other eminences, called corpora pyramidalia lateralia, or restiformia. They run obliquely upwards and outwards towards the cerebellum, in which they are expanded.

At the posterior and upper part of the medulla oblongata, and between the corpora restiformia, is a triangular depression, called sinus of the fourth ventricle, or calamus scriptorius. It is covered

by some folds of pia mater, and white transverse fibres are observed in it, which appear to be the roots of the auditory nerve.

Lying upon the crura of the cerebellum are two nervous cords, which form the seventh pair. The portio dura or facial nerve, the smallest, anterior, and to the inner side, comes from the posterior edge of the pons varolii, from the groove which separates the corpora olivaria and restiformia. The portio mollis, placed behind and outside the former, commences in the transverse band of the calamus scriptorius, then winds round the corpora restiformia, from which it also receives fibres, and passes over the crura cerebelli, where it generally forms a little ganglion. It is accompanied in part of its course by the facial, to which it generally adheres, and sometimes communicates with it by nervous filaments.

Between the corpora olivaria and restiformia a series of nervous filaments are seen, which constitute the eighth pair of nerves. They are subdivided into superior or glosso-pharyngeal and inferior, forming the par vagum.

The accessory nerve arises from the sides of the corpora restiformia, and the continuation of these cords in the medulla spinalis, between the corpus dentatum and the posterior roots of the cervical nerves.

The great hypoglossal, or lingual nerve, arises between the corporamidalia and olivaria, by three bundles of roots.

Behind the pons varolii is seen the cerebellum.

CEREBELLUM.

The *cerebellum* is situated beneath the posterior part of the cerebrum, and separated from it by the tentorium, and resting on the inferior fossæ of the occipital bone.

It is divided into two lobes, by a fissure occupied by the falx minor.

It is composed of cineritious and medullary matter, forming, by their internal arrangement, the appearance termed *arbor vitæ*.

An oval nucleus of grey substance is found in the medullary part, and, from its border being

notched, is named *corpus dentatum*, or *rhomboideum*.

This is considered to be a ganglion of increase to the formative fibres of the cerebellum.

Its surface is not convoluted, as the cerebrum, but formed into *lamellæ*, with *sulci* or grooves between them.

There are two *vermiform appendages* observed on it; they have the appearance of rounded central ridges, situated superiorly and inferiorly.

Two large cords pass from the cerebellum named *crura cerebelli*, and are continuous with the fibres of the pons varolii.

Between the cerebellum and medulla oblongata is a cavity running downwards and backwards, called the *fourth ventricle*.

It is bounded above by the valve of Vieussens; in front, by the medulla oblongata; behind, by the cerebellum; and below, by a process of arachnoid membrane; laterally, by the processus a cerebello ad testes.

It has a communication above with the third ventricle, through the *foramen commune posterius*.

A depression is observed at the anterior and inferior part of the fourth ventricle, called *calamus scriptorius* from its pen-like form.

The *medulla spinalis* commences by the medulla oblongata, from beneath the pons varolii; it descends through the foramen magnum, down the spine, and terminates at about the first or second lumbar vertebra in the cauda equina.

Early in life it extends almost the entire length of the spinal canal. It is broader transversely, therefore presents a somewhat flattened appearance, and is broader in some parts than in others. The dilated portions are first at its upper part,

where it approaches the pons varolii, next between the third and sixth cervical vertebræ, and again between the tenth dorsal and first lumbar vertebra.

It is composed of white matter externally, and grey internally; the latter, most abundant, is of a crescentic shape when divided transversely, and each lateral crescent is connected by its convex edge with the opposite one by a transverse portion of the same grey matter, which may be named a commissure.

It is divided into two lateral halves by an anterior and posterior fissure, which do not penetrate to the centre. The anterior one is intersected by transverse fibres, which pass from one side to the other, and form the anterior longitudinal commissure; this is not observable along the posterior part, where all the fibres are perpendicular. On the side of each lateral column two other imperfect fissures are mentioned, corresponding with the exit of the anterior and posterior spinal nerves, and between these, at the upper part of the medulla spinalis, about as far as the first dorsal nerve, a depressed line is described, extending from the fissure between the corpus olivare and restiforme.

The part named medulla oblongata is about one inch and a half long, and three quarters of an inch in breadth. It presents eminences which correspond with the other portions of the medulla spinalis, and, from their prominent character, have obtained separate names.

The anterior and posterior eminences, evidently the prolongation of the spinal marrow, are called anterior and posterior pyramids; the substance between these on each side is the corpus olivare. The

line between the latter and the posterior pyramid (also named corpus restiforme) is called the Tractus Respiratorius of Sir C. Bell. The anterior pyramids and corpora olivaria are considered to be the formative fibres of the cerebrum; the posterior pyramids extend into the cerebellum.

The anterior pyramids, or corpora pyramidalia, are united anteriorly by some transverse fibres, forming a commissure.

The olivary bodies are white externally, grey internally. The grey matter, divided transversely, presents a scolloped-shaped margin, and is named corpus dentatum olivare.

The corpora restiformia, or posterior pyramids, diverge as they ascend to the cerebellum, and form the lateral inferior boundaries of the fourth ventricle.

The *arteries* which supply the *brain* are the *two external carotid* and *vertebral arteries.*

The internal carotid artery gives off within the cranium, the *ophthalmic*, the *posterior communicating*, the *anterior*, and the *middle cerebral* arteries.

The vertebral arteries enter the skull through the foramen magnum, and give off the posterior arteries of the cerebellum; they then unite on the basilar process to form the *basilar artery*, which gives off the *superior arteries* of the *cerebellum*, and divides into the *posterior cerebral* arteries, called *profundæ cerebri*, which are distributed to the posterior lobe.

There is a communication between the branches of the internal carotids and basilar artery, forming an arterious circle, called the *circle of Willis*, which surrounds the optic commissure, the infundibulum, corpora albicantia, and pons tarini.

The veins terminate in the various sinuses, which empty themselves into the internal jugular veins.

NERVES.

The *nerves* are white medullary cords, necessary to sensation and motion.

They are composed of very fine filaments called *nervous fibres*, and each fibre is composed of a cellular envelope called *neurilema*, and a central pulp of medullary substance. This pulp is considered by most to be globular.

There are two sets of nerves in the body, those belonging to the cerebro-spinal system, and those of the ganglionic. The former are named nerves of animal life, by Bichat; the latter, nerves of organic life.

Each cerebro-spinal nerve has two extremities, one communicating with the brain or spinal cord, called its origin; the other, distributed to some of the organs or parts of the body, called the termination.

They thus form a communication between objects and the brain, and convey to it the various impressions which constitute the senses.

Nerves communicate with each other in various places, forming what are termed plexuses.

Some nerves have enlarged parts on them called ganglia, differing somewhat in structure from the nerves themselves; their precise use is unknown.

The ganglia of the sympathetic nerve differ in appearance and structure from the cerebro-spinal

ganglia. They are of a redder colour, have a cellular capsule, are more vascular, and are formed of both white and grey matter. They may be looked upon as so many nervous centres.

The nerves arising either from the brain or spinal marrow, are divided into *cerebral* and *spinal nerves.*

CEREBRAL NERVES.

The cerebral nerves are generally described as nine pairs.

The *first pair* or the *olfactory nerves* take their origin by three roots, the outer and inner one medullary, the central one cineritious. The first, which is longest, arises from the inner end of the fissure of Sylvius ; the second from the substantia perforata antica ; the central or grey portion from the substance of the anterior lobe. They soon unite, forming a white triangular cord, lodged in a groove at the base of the anterior lobe, about half an inch from the median fissure ; and covered by the arachnoid, only on their under surface. Each cord is then expanded upon the cribriform plate of the ethmoid bone, to form the olfactory bulb, composed of white and grey matter, which gives out numerous medullary filaments, to pass through the cribriform plate of the ethmoid bone. These filaments, which receive an investment from the dura mater, are distributed upon the septum, roof of the nose, and the superior turbinated bones, by three series of filaments.

The *second pair* or *optic nerves,* arise from the corpus geniculatum externum and nates. They

wind round the crura cerebri, and unite, forming the optic commissure in front of the pituitary fossa, and between the anterior clinoid processes; they then separate and diverge, pass through the foramen opticum, into the orbit, perforate the sclerotica, by several small foramina, to the inner side of the axis of the eye, then pass through the choroid, and are lost or terminate in the retina.

In the commissure, some of the fibres of each nerve cross to the opposite side: those on the outside of each nerve seem to pass forwards on the same side, to their destination. A transverse section of the optic nerve in the orbit presents a dark central spot, named *porus opticus*, dependent upon the arteria centralis retinæ, which enters this nerve and runs along its centre.

The *third pair*, or *motores oculorum*, arise from the inner edge of the crura cerebri; they always run downwards and forwards, between the posterior artery of the cerebrum, and anterior artery of the cerebellum, then pass along the outer edge of the cavernous sinus, then traverse the sphenoidal fissure, enter the orbit between the heads of the external rectus, and divide into two portions, superior and inferior. The superior portion gives off a branch to the superior rectus, and another to the levator palpebræ superioris; the inferior portion, larger, gives off three branches, one to the internal rectus, one to the inferior rectus, and the third to the inferior oblique muscle. The last gives a filament to the lenticular ganglion. They all run along the ocular surface of the muscles. In the cavernous sinus, this nerve is at first situated higher than the other nerves, but on pass-

ing into the orbit, it is below them; just before entering, it communicates with the carotic plexus and ophthalmic division of the fifth.

The *fourth pair*, or *pathetici*, arise from the valve of Vieussens, immediately beneath the tubercula quadrigemina; they run along the side of the pons varolii, perforate the dura mater, pass within the outer wall of the cavernous sinus, then through the sphenoidal fissure, and are distributed to the trochlearis or superior oblique muscle of the eye. They are the smallest and longest of the cerebral nerves within the cranium. In the orbit they mount up over the levator palpebræ muscle, lying between it and the periosteum; and, as they enter the orbit, are the highest of the orbital nerves. Arnold describes a small branch from this nerve in the cranium, which runs upon the tentorium almost as far as the lateral sinus.

The *fifth pair* of nerves, or *trigemini*, resemble spinal nerves, being both for motion and sensation, and having, like them, a double origin. They seem to emerge from the junction of the pons varolii, with the crura cerebelli. The anterior or smallest fasciculus may be traced to the corpus pyramidale. The large posterior fasciculus, composed of nearly a hundred filaments, is derived from the corpus restiforme, conferring sensation. The nerve of each side passing forwards, enters a sheath of dura mater upon the petrous bone, and by expanding forms the semilunar or Casserian plexus on the anterior surface of the petrous portion of the temporal bone, and part of the sphenoid bone. From this plexus, three trunks are given off, the *ophthalmic, superior*, and *inferior maxillary*. The first two are only nerves of sensation, the last a nerve of sensation and motion.

The *ophthalmic trunk*, the smallest of the three, and most internal, runs along the outer wall of the cavernous sinus, below the third and fourth nerves, communicating slightly with the cavernous plexus, then separates into three branches, which perforate the dura mater separately, to enter the orbit by the sphenoidal fissure, they are the following:

1. The *lachrymal* branch, smallest and lowest of the three, passes between the orbit and external rectus, to be distributed to the lachrymal gland, external canthus, and upper eyelid. It communicates by small twigs with the superior maxillary, and a twig or two through the malar bone, to communicate with the deep temporal nerves.

2. The *frontal* branch, largest, passes along the orbit, between it and the levator palpebræ superioris; midway in its orbital course, it divides into two branches, the *supraorbital* and *supra-trochlear;* the latter emerges above the trochlea of the superior oblique, and runs beneath the muscles, then perforates the occipito-frontalis, and is distributed to it and the integuments of the head; the other filament passes out at the supraorbital notch, is distributed to the occipito-frontalis, and parts about the forehead, communicating, as well as the other, with the temporal branches of the portio dura.

3. The *nasal* branch passes between the two heads of the external rectus, then crosses over the optic nerve, communicating in that spot with the lenticular ganglion, and giving off two ciliary branches, which accompany the ciliary nerves of the lenticular ganglion; and at the inner wall of the orbit dividing into two branches, called *nasal* and *infra-trochlear*. The nasal twig emerges at the foramen orbitarium internum anterius, enters the cranium, and passing down in the anterior foramen of the cribriform plate of the ethmoid bone, is distributed to the septum and extremity of the nose. The infra-trochlear twig is distributed to the root of the nose, the tensor tarsi, and lachrymal sac, upper eyelid, and caruncula, and communicates with the supra-trochlear nerve.

The *superior maxillary nerve* leaves the cranium by the foramen rotundum, then crosses the spheno-maxillary fossa, passes along the infra-orbitar canal, escapes at the infra-orbitar foramen, under

cover of the orbicularis palpebrarum and levator labii superioris, and is ultimately distributed upon the cheek.

In its course it gives off the following branches:

1. An orbital branch, which communicates with the lachrymal, and sends twigs to the orbicularis palpebrarum and skin, and a molar twig, which perforates the malar bone, and anastomoses with the deep temporal nerves.
2. Two descending branches, communicating with Meckel's ganglion.
3. Four or five posterior dental branches, which perforate the tuberosity of the superior maxillary bone, to supply the molar teeth, and one filament which runs superficially to supply the gums.
4. Anterior dental, for the supply of the bicuspid, canine, and incisor teeth. These nerves run partly along the walls of the antrum, partly within the bone.

Its terminating filaments communicate with the nasal branch of the ophthalmic and facial twigs of the portia dura, upon the cheek.

The *inferior maxillary nerve*, consisting of two separate portions, passes from the cranium by the foramen ovale of the sphenoid bone.

The two portions unite as soon as they pass through the foramen, but appear to separate almost immediately, in the form of two trunks.

The superior and smallest one gives off the following branches:

1. The *deep temporal* branches, two in number, distributed to the temporal muscle. They perforate the muscle, and communicate with the superficial temporal nerves.
2. The *buccal* branch, supplying the buccinator muscle and muscles of the cheek.
3. The *pterygoid* branch, chiefly to the internal pterygoid muscle.
4. The *masseteric* branch, for the supply of the masseter muscle.

The inferior trunk of the inferior maxillary nerve divides into three branches, the *gustatory*, the *auricular*, and *inferior dental*.

1. The *gustatory* nerve descends, first between the two pterygoid muscles, next between the internal pterygoid muscles and ramus of the lower jaw, then arrives upon the upper surface of the mylo-hyoid muscle, and outer surface of the hyoglossus, accompanies there the Whartonian duct, runs over the sublingual gland, and ultimately arrives at the tip and sides of the tongue, to be distributed to the papillæ. In its course it unites with the inferior dental nerve, by a large branch, and also with the chorda tympani nerve, which attends it for a short distance, then leaves it to pass on to the sub-maxillary ganglion. Filaments are given off from it, to the

Internal pterygoid muscle,
Tonsils, soft palate, gums, and pharnyx,
Sub-maxillary gland,
Hypoglossal nerve,
Sub-lingual gland,
and terminating filaments to the substance and papillæ of the tongue.

2. The *auricular* or *superficial temporal*, passes outwards between the condyle of the lower jaw and external auditory meatus. It runs within the parotid gland, and in that situation divides into two branches, superior and inferior. The superior one passes upwards with the temporal artery, to the side of the head, communicating with the portia dura, and giving a filament to the articulation of the lower jaw and meatus externus. The other branch passes backwards behind the ear, giving filaments to it, and uniting with filaments from the cervical nerves.

3. The *inferior dental* nerve passes first between the pterygoid muscles, then between the internal pterygoid and ramus of the lower jaw, and enters the dental canal; reaching the foramen mentale, it divides into two branches, one runs forwards to the symphysis, uniting with the opposite nerve, and supplying the canine and incisor teeth, the other passing out, called mental nerve, is distributed to the soft parts about the chin and lower lip.

In its course it receives a large short branch from the gustatory; and just before entering the dental foramen, it gives off the mylo-hyoidean branch, to the mylo-hyoid muscle, the sub-maxillary gland, and digastric muscle.

In the dental canal it distributes twigs to the molar and bicuspid teeth.

The *sixth pair* or *abducentes*, arise from the junction of the pons varolii with the corpora pyramidalia; they then pass through the dura mater;

and traverse the inner part of the cavernous sinus, and on the outside of the carotid artery, give filaments to communicate with the sympathetic; they then pass through the sphenoidal fissure, run between the two heads of the external rectus, divide into filaments, and are distributed to the external rectus, or abductor muscle of the eye.

The *seventh pair* consists of two portions, the *portio dura* and *portio mollis.*

The *portio dura*, or *facial nerve*, arises from a fissure between the corpora olivaria and restiformia, near the posterior edge of the pons varolii; it passes along the meatus auditorius internus in a groove of the portio mollis, and here unites with it slightly, then enters the canal of Fallopius, where it unites with the petrous branch of the vidian nerve; in its course it gives a filament to the tensor tympani, and to the stapedius muscle.

It then emerges at the foramen stylo-mastoideum, and, before its ultimate division, gives off three small branches:

1. The *posterior auricular* to the occipital muscle, the retrahens aurem, and external meatus.
2. The *stylo-hyoid* to the stylo-hyoid and digastricus muscles.
3. The *digastric* branch to the posterior belly of the digastric muscle.

These three filaments all communicate with the neighbouring nerves.

The portio dura then enters the parotid gland, and divides into two, three, or more branches, named temporo-facial, and cervico-facial, which, by communicating filaments, form the pes anserinus: from this, three sets of branches pass off:

1. The temporal pass up over the zygoma, ramifying on the head and ear, and anastomosing with the occipital and frontal nerves.

2. The malar branches anastomosing with the superior and inferior maxillary nerves, and supplying the muscles of the face.

3. Descending branches anastomosing with the inferior maxillary on the lips and chin, and with the cervical nerves in the neck, supplying the platysma and integuments.

The filaments of the portio dura give the power of motion to the various muscles upon which they are distributed.

The *portio mollis* arises from the anterior part or floor of the fourth ventricle; it enters the meatus auditorius internus, in company with the portio dura, separated from it only by a small artery given off from the basilar: at the bottom of the canal it divides into minute filaments, which form two fasciculi; the anterior go to the cochlea, the posterior to the vestibule and semicircular canals.

The *eighth pair* consists of three nerves:

1st. The *glosso-pharyngeus* arises from the side of the medulla oblongata, in the groove between the corpus olivare and restiforme, and between the portio dura and nervus vagus; it passes forwards and out of the cranium, by the foramen lacerum posterius, anterior to the jugular vein; it descends perpendicularly almost in front of the carotid artery, passing between the stylo-pharyngeus and stylo-glossus muscles, towards the root of the tongue; as it escapes from the cranium it forms a ganglionic enlargement.

The branches given off from it have been minutely traced by Arnold (vide Icones Nervorum Capitis), and are the following:

The tympanic branch from the ganglion, gives a filament to the carotic plexus, to the vidian in the hiatus Fallopii, and one to the otic ganglion.

A branch to anastomose with the portio dura.

A branch to the nervus vagus and accessorius.
Branches to the stylo-hyoid and digastric muscle.
Pharyngeal branches to the pharyngeal plexus.
Tonsillary branches.
Terminal branches to the mucous membrane and follicles at the root of the tongue.

2d. The *nervus vagus, par vagum,* or pneumogastric nerve, arises just below the glosso-pharyngeus in the same fissure: it forms a flattened band and passes out of the cranium by the foramen lacerum posterius, invested by a prolongation of dura mater; just at its exit it has a gangliform enlargement, and communicates with the lingual, the glosso-pharyngeal, and sympathetic nerves; it next lies upon the rectus capitis anticus major, descends in the neck enclosed in the carotid sheath between the carotid artery and jugular vein; enters the thorax between the subclavian artery and vein, on the right side, giving off the right recurrent branch, which curves round the subclavian artery, and runs along the side of the trachea to the larynx; on the left side it enters the chest parallel with the left subclavian artery, and sends off a recurrent branch, which winds round the arch of the aorta to be distributed like the recurrent of the right side; it then gives filaments to the bronchi, and passes downwards and backwards to the œsophagus, to which it supplies numerous filaments, which interlace freely together, forming the œsophageal plexus, these reunite and form a trunk on each side of the œsophagus, that on the right side being behind, that on the left being in front, and passing through the diaphragm, is finally distributed upon the stomach.

The particular branches of the par vagum are the following:

1. The *pharyngeal* branch, which, with filaments of the sympathetic, laryngeal, and glosso-pharyngeal nerves, forms the pharyngeal plexus upon the middle constrictor.

2. The *superior laryngeal* nerve, which descends on the inside of the carotid artery, and divides into two branches; the external one distributed to the thyro-hyoid, sterno-hyoid, and crico-thyroid muscles, and the thyroid gland; the other internal perforating the thyro-hyoid ligament is distributed to the epiglottis and its glands, the arytenoid muscle, the membrane lining the larynx, and the crico-thyroid muscle, and anastomoses with the inferior thyroid.

3. *Cardiac* branches, to anastomose with the superficialis cordis.

4. The *recurrent* or *inferior laryngeal* passes along the side of the trachea, and reaching the larynx is distributed to the crico-arytenoid and thyro-arytenoid (dilator) muscles; in its course it gives filaments to the pulmonary plexus, to the œsophagus and under surface of the trachea, to the inferior constrictor of the pharynx, and anastomoses with the superior laryngeal nerve.

5. *Bronchial* branches, forming, with the recurrent and sympathetic, the anterior and posterior pulmonary plexus.

6. *Œsophageal* branches, forming a plexus around the œsophagus.

The terminating branches ramify on the stomach, anastomosing with the hepatic, coronary, and solar plexus.

3d. The *nervus accessorius*, or superior posterior respiratory nerve, takes its origin in the cervical portion of the spinal cord, as low as the fourth or fifth cervical vertebra; it then passes into the cranium, through the foramen magnum, and quits it, by the jugular foramen; passing behind the internal jugular vein, it descends in the neck, perforating the sterno-mastoid muscle, to which it gives filaments, and is ultimately distributed to the trapezius muscle.

The *ninth*, hypoglossal, or lingual, arises from between the corpora pyramidalia and corpora olivaria: the fibres unite into a trunk on each

side, which passes out at the anterior condyloid foramen, internal to the par vagum and sympathetic; it passes forward between the internal carotid artery and internal jugular vein, and descends and runs parallel with the lower margin of the digastric muscle; as it turns forwards it hooks round the occipital artery, and here gives off its descendens noni branch, then runs above the os hyoides on the outer surface of the hyo-glossus muscle, and is ultimately distributed to the genio-hyo-glossus and lingualis muscles. The branches from it are the following:

Filaments to connect it with the glosso-pharyngeal, nervus vagus, accessorius, sympathetic, and nervous loop of the atlas.

The *descendens noni* branch, which runs down upon the carotid sheath, and, anastomosing with filaments of the cervical nerves, forms an arch, convex downwards, from which filaments are distributed to the omo-hyoid, sterno-hyoid, and sterno-thyroid muscles.

Filaments to the stylo-pharyngeus, constrictors of the pharynx and crico-thyroid muscle.

Filaments to surrounding muscles.

Filaments to communicate with gustatory and terminal filaments, to the lingualis and genio-hyo-glossus muscles.

The *spinal nerves* consist of thirty-one pairs: eight cervical, including the suboccipital, twelve dorsal, five lumbar, and five sacral nerves.

They arise by two fasciculi: those from the front give the power of motion; those from behind give sensation: they pass through the dura mater, then unite and perforate the lateral foramina of the vertebral canal, dividing into an anterior and posterior series. The anterior ones are generally the largest. A ganglion is formed on the posterior fasciculus, within the dura mater, before the union, and before the dura mater entirely quits the nerve.

CERVICAL NERVES.

The first *cervical*, or *suboccipital*, the smallest of the series, passes out of the spinal canal between the occipital bone and arch of the atlas: it then appears in the triangular space bounded by the rectus capitis posticus and oblique muscles, and divides into an anterior and posterior branch. The *posterior* one gives filaments to the small adjacent muscles and complexus, and a descending filament to the next nerve. The *anterior* branch runs forwards to the anterior surface of the spinal column, where it gives off the following filaments:

One to the second cervical nerve, descending before the atlas, and forming the *nervous loop* of the atlas.
..... nervus vagus.
..... lingual nerve and first cervical ganglion.

The next three cervical nerves, uniting together by anterior descending branches, are described as forming the cervical plexus. Their posterior branches may be described as given off separately.

The second cervical nerve emerges between the atlas and vert. dentata. The posterior branch, named *great occipital nerve*, larger than the anterior, runs upwards and backwards towards the occiput, and perforates the complexus muscle; after which it ascends with the occipital artery, and is distributed over the scalp, communicating with the frontal branches of the ophthalmic, ascending branches of the pes anserinus, and

auricular branch of the third cervical nerve. In its course it gives filaments to the

First and third cervical nerves;
Posterior recti, and oblique muscles;
Splenius,
and complexus.

The third cervical nerve emerges between the vert. dentata and third cervical vertebra.

Its *posterior* branch, smaller than that of the second, winds backwards, perforates the muscles to become subcutaneous, and is distributed to the back of the head and neck. It gives off filaments to the second and fourth cervical nerves, and the various contiguous muscles.

The fourth cervical nerve emerges, like the former, from between the third and fourth cervical vertebræ. Its *posterior* branch is very small: it runs between the transverse processes of the corresponding vertebræ, gives filaments to the complexus splenius and trapezius, perforates the two latter muscles, and terminates in the integuments of the neck.

The anterior branches of the second, third, and fourth cervical nerves unite by filaments, soon after their exit; they communicate by filaments with the superior cervical ganglion, sometimes with the middle ganglion. They form the *cervical plexus*. This plexus rests upon the splenius colli, the anterior border of the scalenus posticus and levator anguli scapulæ, and is covered over by the sterno-mastoid muscle: the branches given off from it may be divided into superficial and deep. Most of the former are seen winding round the posterior edge of the sterno-mastoid muscle, to reach its external surface; and some descending as far as the clavicle.

The *superficial* branches are the following:

1. *Posterior*, or *small occipital*, ascends along the posterior edge of the sterno-mastoid muscle to the occiput, giving filaments to the back of the ear and occipital integuments. It anatomoses with the nervus accessorius and portio dura.

2. *Middle*, or *great auricular nerve*, first crosses the sterno-mastoid muscle, a short distance above the external jugular vein, ascends towards the parotid gland, where it divides into filaments; some enter the gland and unite with the portio dura, others mount up in front of the ear, others ascend behind it, and are distributed to the integuments.

3. The *anterior branch*, *transverse cervical* or *superficialis colli*, ascends and inclines towards the submaxillary gland, supplying filaments to the digastric muscle and platysma myoides, and to the submaxillary ganglion, or plexus; thus communicating with the lingual and chorda tympani.

4. The *descending filaments* pass between the trapezius and sterno-mastoid muscle, and are distributed to the integuments about the clavicle, acromion, the omo-hyoid, and serratus magnus muscle. They may be named, *supra-clavicular*, *supra-acromial*, and *subclavicular*.

The deep branches of the cervical plexus are the following:

Some, to communicate with the nervus accessorius, and to supply the trapezius and levator anguli scapulæ.

Branches to unite with the descendens noni, forming an inverted arch, from which filaments, as before described, pass off.

The *phrenic*, chiefly derived from the third and fourth, receives also a filament from the fifth cervical nerve. It descends in the neck, upon the anterior scalenus muscle; enters the chest, between the subclavian artery and vein, communicating here with the nervus vagus, or recurrent nerve, and inferior cervical ganglion; it then passes anterior to the root of the lungs, runs between the pleura and pericardium, which it grooves, and arrives at the diaphragm, to the muscular fibres of which it is principally distributed; on the right side it sends filaments through the opening of the vena cava, to the surface of the liver; others penetrating the diaphragm, and reaching its under surface, accompany the branches of the phrenic artery, to reach the solar plexus.

The left phrenic nerve is longer than the right, having to wind round the apex of the heart.

The fifth, sixth, seventh, and eighth cervical nerves, with the first dorsal, by their anterior branches, and filaments from the sympathetic, form the *brachial plexus*. The posterior branches of the four inferior cervical nerves are very small, and are distributed to the deep-seated muscles and integuments of the immediately surrounding parts.

The nerves about to form the *brachial plexus* pass out from between the scaleni muscles, and then combine to form this plexus. The fifth and sixth form together a single trunk, as also the eighth cervical and first dorsal, whilst the seventh cervical runs some distance before joining the plexus. It passes downwards and outwards beneath the subclavius muscle, and over the first rib; and in the axilla, opposite the coracoid process, divides into its terminal branches.

Its branches consist of those distributed to parts above the arm, and those which go to the arm entirely; of the latter there are six, namely, the external and internal cutaneous, the circumflex, ulnar, median, and musculo-spiral, or radial: of these, three only reach the fingers, namely, the ulnar, median, and musculo-spiral. The first series from the plexus includes the suprascapular, subscapular, and thoracic nerves.

The *suprascapular nerve*, given off from the plexus, high up, passes outwards and backwards towards the superior margin of the scapula, accompanying the artery of the same name. It runs through the supra-scapular notch, where it gives off a branch to the supra-spinatus muscle, and passing beneath the acromion process, is distributed to the infra-spinatus and teres minor muscles.

The *subscapular* branches are generally three; they run down in the course of the subscapular artery, supplying filaments to the subscapularis muscle, teres major, and latissimus dorsi.

The *thoracic* nerves are three or four in number: two of these run down in front of the axillary vessels, to reach the pectoralis major and minor, upon which they are distributed; the other, named posterior thoracic, descends behind the axillary vessels to the inside of the axilla, distributing filaments to the serratus magnus muscle. It is the posterior inferior respiratory nerve of Sir C. Bell. This nerve is described by many as coming off from the cervical plexus, at about the same point as the phrenic nerve, but posterior to it.

NERVES OF THE ARM.

The *internal cutaneous* nerve is the smallest of the brachial branches of the plexus: it descends along the inside of the arm, under the fascia, and divides, near the elbow, into two branches, which perforate the fascia, and then run quite superficially. Before the division, it gives off filaments which perforate the fascia, and are distributed to the integuments covering the triceps and biceps. The terminal branches are the following:

The *anterior* branch passes over the median basilic vein, and descends as far as the wrist: in its course giving filaments to the integuments; some to communicate with the external cutaneous, and some to join with the other branch of the same nerve.

The *internal* branch inclines quite to the inner side of the forearm, and runs down to the wrist; in its course it gives filaments to the integuments, some to unite with the other branch, and terminating filaments to the inner border of the hand.

The *external cutaneous* nerve, also named *musculo-cutaneous* and *perforans casserii*, larger than the former, proceeds from the upper and external portion of the plexus: descends, and generally perforates the coraco-brachialis muscle; then runs downwards and outwards under the biceps and upon the brachialis anticus muscle; then between the biceps and supinator radii longus; it then per-

forates the fascia and becomes superficial, runs between the median cephalic vein and fascia, and descends as far as the wrist, where it terminates. Its branches are the following:

Muscular filaments to the coraco-brachialis, biceps, and brachialis anticus.

Filaments to the integuments, communicating with those of the internal cutaneous and musculo-spiral.

Terminating filaments to the root of the thumb and the wrist, communicating with cutaneous filaments of the median.

The *circumflex* nerve proceeds from the posterior part of the plexus, backwards and outwards, beneath the inferior edge of the subscapularis muscle, accompanies the posterior circumflex artery behind the humerus, and winds round it, to reach its anterior-external surface, where it is finally distributed to the deltoid muscle. It also gives filaments to the subscapularis, teres major, and triceps, and to the skin covering the latter.

The *ulnar* nerve arises from the inner side of the plexus, descends along the inner side of the arm, supported by the short head of the triceps, as far as the space between the inner condyle and the olecranon; here it passes between the two origins of the flexor carpi ulnaris, and along the fore-arm, rests upon the flexor digit. profundus, to the ulnar side of the artery, over-lapped by the flexor carpi ulnaris; lower down it runs distinctly along the radial edge of the flexor ulnaris; when arrived at the wrist it passes over the annular ligament with the ulnar artery, and in the hand divides into two terminating branches, the superficial and deep. The filaments given off by it are the following:

One or two to teres major and latissimus dorsi.
..... to the long and short head of triceps.

In the fore-arm filaments to the adjacent flexor muscles, communicating with the median.

A branch quits it, about the upper part of the lower third of the fore-arm, runs under the flexor carpi ulnaris, and arrives at the surface of the extensor ulnaris to reach the little finger. It gives a filament to the abductor minimi digiti, and another which bifurcates to supply the opposed surfaces of the ring and little finger, and communicates with the digital filaments of the musculo-spiral.

The *superficial* branch of the hand goes to supply the little finger and half the ring finger; one branch of it runs along the muscles of the little finger, giving them filaments, and courses along the ulnar side of this finger, as far as the tip; the other filament runs along the surface of the adductor minimi digiti, and having united with a filament from the median, on arriving at the head of the fourth and fifth metacarpal bones, bifurcates to supply the opposed surfaces of the ring and little fingers.

The *deep-seated* palmar branch, forming the deep arch of nerves, sinks deep in the hand, passing beneath the adductor minimi digiti, and running upon the interossei muscles, beneath the flexor tendons, and terminating by filaments to the adductor pollicis. It gives filaments to the small muscles of the fingers, and to the interossei muscles.

The *median nerve* takes its origin from the brachial plexus, by two roots which embrace the axillary artery; they soon unite, to form a single nerve, which descends about half way down the arm, on the outer side of the brachial artery; after which it inclines over the artery, then gets to its inner side, gradually diverging from it, so that at the bend of the elbow there is a distinct space between them; in this course it rests upon the coraco-brachialis and brachialis anticus, internal to the biceps muscle; it then sinks in the space between the pronator teres and supinator longus, passes between the two origins of the pronator teres, and descends between the flexor sublimis and profundus, passes under the annular ligament at the wrist, and terminates in the hand by its

digital branches. The branches and filaments given off by it are the following:

A few *muscular* twigs in the arm, to the muscles which arise from the inner condyle.

The *anterior interosseous* nerve, which accompanies the corresponding artery, runs between the flexor profundus and flexor pollicis longus, as far as the pronator radii quadratus; it runs beneath this, and perforates the interosseous ligament, to arrive at the dorsal surface of the hand, to which it distributes filaments.

A small branch near the wrist passes over the annular ligament to the skin of the palm of the hand.

The terminating digital branches are five; and, with a branch from the ulnar, form the superficial palmar arch of nerves:

The first goes along the outside of the thumb, to its extremity, giving filaments to the abductor and flexor brevis.

The second runs along the inside of the thumb.

The third gives filaments to the abductor indicis and first lumbricalis, and runs along the outside of the index finger.

The fourth takes the course of the second metacarpal space, gives a filament to the second lumbricalis, and bifurcates to supply the opposed sides of the index and middle fingers.

The fifth lies in the next metacarpal space, supplies the third lumbricalis, and bifurcates to supply the opposed sides of the middle and ring fingers; this branch communicates with the ulnar nerve, as before mentioned.

The *musculo-spiral* or *radial* nerve, one of the largest branches of the brachial plexus, emerging from its centre and posterior part, soon after its origin inclines downwards, outwards, and backwards, winds round the humerus, under the second head of the biceps, accompanied by the superior profunda artery; it next appears between the supinator longus and brachialis anticus, between which it runs as far as the elbow, where it divides into an anterior or external and a deep-seated branch.

The *anterior* branch descends with the supinator longus muscle, and, at about the middle third of the fore-arm, arrives at the outer side of

the radial artery, which it accompanies for about two or three inches; it then leaves it, passing under the supinator muscle, running superficially to the extensor muscles of the thumb, and just above the wrist, dividing into terminal branches which reach the back of the hand. The filaments from it are,

Several *muscular* filaments to the supinator and extensor muscles.

Terminal filaments, generally three in number; one to the radial side of the thumb.

One bifurcates to supply the ulnar side of the thumb and the radial side of the index finger.

The third bifurcates to supply the opposed sides of the index and middle fingers, and occasionally a fourth supplies the opposed sides of the middle and ring fingers.

The *deep-seated* branch, larger than the other, passes backwards and downwards beneath the supinator longus and two radial extensors, then perforates the supinator brevis, and divides into several filaments.

Some to the extensors of the thumb and fingers.

One named *posterior interosseous*, which descends with the deep-seated extensor muscles, as far as the back of the carpus. It supplies the muscles in its course.

The filaments of the musculo-spiral given off before its division, are the following:

Two or three to the triceps: one of these arrives at the skin, and has been named *superior external cutaneous* nerve; it descends upon the fore-arm, and communicates with the external cutaneous nerve.

Then the muscular branches before mentioned.

In addition to the nerves above described as coming from the brachial plexus, the inside of the arm is supplied with branches given off from the

second and third intercostal, and have been named the cutaneous nerves of Wrisberg.

DORSAL NERVES.

The dorsal or intercostal nerves are twelve on each side. They emerge from the intervertebral foramina; the first between the first and second dorsal, the last between the last dorsal and first lumbar vertebra. Immediately after their exit they divide, like the cervical, into anterior and posterior branches; the posterior branches run backwards between the transverse processes of the vertebræ, to supply the deep muscles of the back, and the integuments.

The *anterior* branches, named also intercostal, run along the intercostal spaces, below the vein and artery, and near the margin of each rib, between the external and intercostal muscles: about midway between the spine and sternum they give off a large superficial branch. The continued portion of the seven superior nerves is distributed to the intercostal muscles and triangularis sterni, and then perforates these, to be lost finally in the pectoralis major and integuments.

The next four intercostal nerves, corresponding with the four superior false ribs, on reaching the ends of the cartilages, pass forwards between the internal oblique and transversalis muscles, to reach the rectus abdominis, supplying filaments to all these muscles.

The filaments from these several dorsal nerves are as follows:

From each a filament or two of communication to the contiguous ganglion of the sympathetic.

The first dorsal nerve is large, and enters almost entirely into the formation of the brachial plexus.

The superficial branches of the second, third, and occasionally the fourth, after perforating the external intercostal muscles, cross the axilla, descend to the inside of the arm, as low down as the inner condyle, communicating with the internal cutaneous nerve. They are by some named *intercosto-humeral* nerves, or nerves of Wrisberg.

The superficial branches of the seven succeeding intercostal nerves are distributed to the mammæ, pectoralis major, external oblique muscle, and integuments, according to their situations.

The twelfth dorsal differs from all the others; it first sends a large branch to the first lumbar nerve, then passes forwards and a little downwards upon the quadratus lumborum, at the edge of which it divides into two filaments; the deep one passes forwards to the space between the transversalis and internal oblique muscle, to reach the rectus, supplying filaments to each; the superficial filament runs between the internal and external oblique muscles, supplying them and the integuments.

LUMBAR NERVES.

The lumbar nerves are five in number, and have a double origin, like the dorsal nerves. They form part of the cauda equina. They pass out of the canal at the inter-vertebral foramina, and, soon after their exit, divide into anterior and posterior branches: the first emerges between the first and second lumbar vertebræ, the fifth between the last lumbar vertebra and the sacrum.

The *posterior* branches take a course backwards, between the corresponding transverse processes of the vertebræ, and supply the deep lumbar muscles.

The *anterior* branches pass downwards and somewhat outwards, are connected together by twigs, and, with the filaments of the sympathetic, form an interlacement, named Lumbar plexus. These nerves increase in size from above downwards.

The *Lumbar plexus* is formed in the substance of the psoas muscle, by the four superior lumbar nerves, and receives branches from the last dorsal and the sympathetic ganglia, along the sides of the bodies of the lumbar vertebræ.

The branches given off by the plexus are :

Musculo cutaneous,
External cutaneous,
..... pudic,
Crural,
Obturator,
and a communicating branch to the sacral plexus.

The musculo cutaneous branches, two in number, chiefly from the first lumbar nerve, pass through the psoas muscle, forwards upon the anterior surface of the quadratus lumborum, to reach the crista ilii. These branches may be considered external and internal.

The *external,* named also *ilio-scrotal,* passes between the transversalis and internal oblique muscles, and gives off filaments which supply the transversalis and iliacus muscles, and subcutaneous filaments to the gluteus medius and maximus; one part of it passes forwards along the crista of the ilium, then follows Poupart's ligament, and gives filaments to the spermatic cord, the pubes, and scrotum, and in females, to the labia.

The *internal* branch runs between the transversalis and internal oblique, and then between the latter and external oblique muscle, and is ultimately lost in the groin and scrotum.

The *external cutaneous nerve,* arising chiefly

from the second lumbar, passes downwards and forwards, upon the iliac fascia, towards the anterior superior spinous process of the ilium, below which it passes and gets out of the pelvis; it pierces the fascia lata, and is distributed by two filaments; one passing downwards and sub-cutaneous to the outer part of the thigh, the other running down as far as the outside of the knee.

The *external pudic nerve*, also named *genito-crural* or *external spermatic*, appears to come off chiefly from the second lumbar nerve; it pierces the psoas muscle, and descends upon its anterior surface, and at the crural arch divides into two branches, named internal and external.

The *internal* branch accompanies the spermatic cord of the male, or round ligament in the female, and is distributed to the cremaster and coverings of the testicle and adjacent parts of the groin; or to the pubes and labia of the female.

The *external* branch is distributed to the glands and parts in front of the thigh.

The *crural nerve* appears to be derived from the second, third, and fourth lumbar nerves. It is at first placed between the psoas and iliacus muscles, descends under the fascia iliaca, and then passes under the crural arch on the outside of the psoas muscle, which separates it from the femoral artery. In this course it gives twigs to the iliacus and psoas muscles. After passing Poupart's ligament it divides into several branches, superficial and deep. The superficial branches soon pierce the fascia lata, and extend as far as the front and inner side of the knee. The deep branches may be divided into

External,
Internal,
Descending.

The *external* branches pass in front of the iliacus and psoas, supplying filaments to the Sartorius, Rectus, Tensor Vaginæ Femoris, two Vasti and Cruræus muscles.

The *internal* branches pass beneath the femoral vessels to supply the pectineus and adductor longus.

The *descending* branches accompany the femoral artery ; one, *shorter*, runs on its outer side, giving filaments to the sartorius, and is lost in the vastus internus, near the knee. The *longer* branch runs on the sheath of the artery, and passes under the fascia, which extends from the adductors to the vastus internus ; it quits the artery at the opening of the great adductor, and runs along the inside of the knee, and then accompanies the internal saphena vein, as far as the dorsum of the foot, where it terminates, by sending filaments to the inner side of the foot and great toe. This branch is named *nervus saphenus internus.*

The *obturator nerve* seems to arise from the third and fourth lumbar, passes along the inner edge of the psoas, between the peritoneum and pelvic fascia to reach the obturator foramen, which it passes through, and then gives off branches

To the *external obturator muscle,*
A filament to the hip-joint,
A deep posterior branch to the adductor magnus,
An anterior branch to the gracilis, and long and short adductors, and inside of the knee.

The *Lumbo-sacral nerve* is the last given off from the lumbar plexus. It is formed from the anterior branch of the fifth and a twig from the fourth; it passes down to the pelvis, and unites with the first sacral, so as to contribute to form the sacral plexus.

The only nerve given off from it is the superior *gluteal nerve*, which passes out by the sacro-sciatic notch, with the gluteal artery, and is distributed to the gluteal muscles.

The *sacral nerves* are five or six on each side,

each consisting of an anterior and posterior branch; they arise from the cauda equina, and emerge from the sacral foramina.

The four *superior posterior* branches pass out at the posterior sacral foramina, perforate the tendon of the sacro-lumbalis and become superficial, and are distributed to the skin covering the nates.

The inferior *posterior* branches run downwards to supply the integuments about the anus.

The *anterior* branches pass out at the sacral foramina, decreasing in size as they come out, from above downwards. They all communicate with the sacral ganglia of the sympathetic. The three superior nerves with descending branches from the fourth and fifth lumbar nerves, and a branch from the fourth sacral, form the *sacral plexus*.

The fourth nerve gives filaments to the hypogastric plexus, levator ani, coccygeus, the skin above the anus, and sphincter ani.

The fifth and sixth sacral nerves are very small and are lost in the coccygeus and sphincter ani.

The *sacral plexus*, formed as above mentioned, rests upon the pyriformis muscle, and gives off internal and external branches. The internal branches are

Hæmorrhoidal,
Vaginal,
Uterine,
Vesical,
Pudic.

The external branches are

Great Sciatic,
Small Sciatic.

The *hæmorrhoidal branches* pass to the muscu-

lar and mucous coat of the rectum, and communicate with the neighbouring nerves.

The *vaginal* and *uterine* branches ramify as their names imply.

The *vesical* branches pass to the lower part of the bladder, and supply its muscular and mucous coat, the prostate gland, and vesiculæ seminales; and in the female, the urethra.

The *pudic* nerve is the largest of the internal branches, and appears to come chiefly from the third sacral. It follows very closely the course of the pudic artery; the branches given off by it are,

A *superficial perineal* branch, which gives off long twigs to the sphincter ani, and margin of the anus, and filaments to the erector penis, accelerator urinæ, and transversus perinæi, and is lost upon the dartos and scrotum.

Branches to the obturator internus

..... integuments, urethra, and glans penis.

The superficial perineal branch is largest in the female, and is distributed chiefly upon the labia.

The *small sciatic nerve* gets out from the pelvis below the margin of the pyriformis muscle, to the inner side of the great sciatic nerve, supported by the superior gemellus, and overlapped by the gluteus maximus. Its branches are,

Inferior gluteal, consisting of small filaments, to the gluteus maximus.

Posterior and *internal cutaneous,* which passes inwards, beneath the tuber ischii, gives filaments to the gracilis, and, perforating the fascia, is distributed to the integuments about the inside of the thigh, scrotum, or labia.

Middle cutaneous pierces the fascia, and descends, supplying the skin, as far as the popliteal space.

The rest of the nerve descends and gives filaments to the flexor muscles, as far as the inside of the ham.

The *great sciatic nerve* is the largest nerve of

the body. It passes out of the pelvis below the pyriformis muscle, then descends between the great trochanter and tuber ischii, over the small rotators, viz. the gemelli, obturator internus, and quadratus femoris, then rests upon the adductor magnus, under cover of the flexors of the thigh, and descends towards the popliteal space.

There are small branches given off by it

to the internal obturator muscle, and to the lesser sciatic nerve.
filaments to the gluteus maximus.
..... flexor muscles.
superficial branches which pierce the fascia, and are distributed to the outside of the knee, forming external cutaneous branches.
filaments to the external rotators.
..... hip joint.
..... adductor magnus, and
..... short head of the biceps.

The great sciatic nerve divides about midway down the thigh into two branches, the *tibial* and *peroneal*, the former being named *popliteal* till it reaches the leg, and appears to be the proper continuation of the sciatic nerve.

The popliteal nerve passes down in the popliteal space, under the fascia, but superficially to the artery and vein; after passing the joint it rests on the popliteus muscle, under cover of the gastrocnemius, then crosses the posterior tibial artery, and descends on its outer side, and is here properly named posterior tibial nerve, it then passes down with the artery, and in the sole of the foot divides into external and internal plantar nerves.

The branches given off by this nerve are:

Muscular twigs in its course.

A long branch given off in the popliteal space, (named *communicans tibiæ*), descends between the two heads of the gastro-

cnemius, then over its posterior surface, running downwards to the outer border of the tendo achillis; it accompanies the saphena minor vein, and about the middle of the leg unites with a similar branch sent off from the peroneal nerve. This external *saphenous* nerve passes behind the outer ankle to the dorsum of the foot, where it divides into filaments, and forms the fourth and fifth metatarsal nerves, which extend to the digital phalanges. In its course down the leg it gives filaments which pierce the fascia and become subcutaneous.

The posterior tibial nerve in its course down the leg supplies filaments to the muscles in its immediate proximity, viz. the plantaris, gastrocnemius, solæus, tibialis posticus, and long flexors of the leg, and lower down gives filaments to the ligaments of the ankle, bursa and fascia about the tendo-achillis.

In the hollow of the foot this nerve gives off a filament to the integuments of the sole, and then divides into external and internal plantar nerves.

The *internal plantar nerve*, the larger of the two, takes the course of the internal plantar artery, gives branches to the abductor pollicis, flexor brevis digitorum, and accessorius, and divides into four filaments, very like the median in the hand; one branch, the smallest, passes to the inside of the great toe, the three others bifurcate to supply the opposed sides of the first, second, third, and fourth toes, giving filaments to the lumbricales and interossei muscles; the fourth nerve gives off a filament to communicate with the superficial branch of the external plantar nerve.

The *external plantar* nerve runs forwards between the flexor brevis and accessorius, in its course giving a branch to the abductor minimi digiti; it then divides into a superficial and deep branch. The *superficial* branch gives off a filament to the outside of the little toe, and then runs

in the space between the fourth and fifth toe, giving a communicating filament to the fourth terminating branch of the internal plantar nerve, and afterwards separates into two filaments to supply the opposed sides of the fourth and fifth toes.

The deep seated branch runs close upon the metatarsal bones, supplying filaments to the interossei, flexor brevis pollicis, and transversalis pedis muscles.

The *peroneal* or *fibular* nerve, one of the branches of the great sciatic, in its course is inclined outwards, and descends between the biceps and outer head of the gastrocnemius, to reach the head of the fibula: a little below this it winds round the neck of the bone, and divides into two branches, the *anterior tibial*, or *interosseous*, and the *musculo-cutaneous*: the latter, in its direction, appears to be the continuation of the nerve, and descends between the peronæus longus and extensor communis digitorum longus, giving branches to them in its course. About the middle of the leg it escapes from between the muscles and descends between the extensor muscles and fascia, and divides into two branches.

The *external* branch descends and passes in front of the outer ankle, reaches the dorsum of the foot, and gives off three filaments, one to supply the dorsum of the little toe and outside of the foot; another passes between the fourth and third toes, supplying both, and a third is distributed between the second and third toes.

The *internal* branch goes to supply the inner border of the foot, and gives filaments to the upper surface of the first and second toes.

The branches of the peroneal, in its course downwards, are one in the popliteal space, to the short head of biceps, terminating in the ligaments

on the outside of the joint, a branch which descends between the gastrocnemius externus and fascia, and gives off filaments which ramify on the outside of the leg, and one which unites with the superficial branch of the posterior tibial nerve, to form the external saphenus nerve.

The *anterior tibial* or *interrosseous nerve*, directly after its separation from the other branch of the perineal, winds forwards and inwards between the fibula, the peroneus longus, and extensor communis, to which it gives filaments; it then arrives at the interosseous ligament, and accompanies the anterior tibial artery, lying to its outer side, but lower down, rather in front of it, in which position it passes under the annular ligament to the dorsum of the foot. In its descent it gives filaments to the adjacent muscles, and on the foot divides into two branches:

One supplying the extensor brevis and the interossei and communicating with the peroneal nerve.

The other passes to the first and second toes.

SYMPATHETIC NERVE.

The sympathetic nerve (or nerves, as there is a similar structure on each side of the body,) was formerly called the great intercostal nerve, and was described as commencing in the cavernous sinus, by filaments from the fifth and sixth cerebral nerves. It is now viewed as a separate nervous system, named *ganglionic*, and is described as consisting of a series of ganglia, or nervous centres, connected together by filaments,

and communicating in various parts with filaments derived from the cerebro-spinal nerves. From its apparent functions it is called the nerve of organic life. The ganglia are found in five regions of the body; namely, the head, neck, chest, abdomen, and pelvis, and are named accordingly.

The *cranial* ganglia are the *ophthalmic*, *spheno-palatine*, *otic*, *ganglion* of *Cloquet*, *submaxillary*, *carotic*, and a disputed one upon the arteria communicans, named *ganglion* of *Ribes*.

The cervical ganglia are three;

The dorsal, twelve;

The lumbar, five;

The sacral, four or five on each side, with an azygos ganglion near the coccyx.

The *ophthalmic* or *lenticular* ganglion is situated within the orbit between the optic nerve and external rectus muscle, and midway between the entrance of the optic nerve and the sclerotic coat. It is small, and is imbedded in a large quantity of fat.

The filaments from it are,

Anteriorly, fifteen to twenty, named ciliary; they pass forwards, perforate the sclerotic coat at its posterior part, run forward between the sclerotic coat and choroid, and part of them pass into the iris; the greater number are lost in the ciliary ligament.

Posteriorly, at the upper angle, a filament to the nasal nerve of the fifth.

at the inferior angle, a filament to the inferior division of the third cerebral nerve.

a third filament passes backwards to reach the carotic plexus.

The *spheno-palatine*, or *Meckel's* ganglion, is situated in the pterygo-maxillary fossa, having in front the tuberosity of the superior maxillary bone; behind, the roots of the pterygoid processes;

internally, the palate bone and spheno-palatine foramen; and externally, the soft parts filling up the fossa. The branches of this ganglion are ascending, descending, internal, and posterior.

The *ascending*, or superior, are usually two, and very large; they unite with the superior maxillary nerve.

The *descending* are the palatine nerves, three in number. The *great palatine* nerve descends in the great palatine canal, and emerges at the posterior palatine foramen, from which it runs forward beneath the arch of the palate, as far as the foramen incisivum, where it communicates with Cloquet's ganglion. In its course it gives filaments, through the nasal plate of the palate bone, to the pituitary membrane of the nose, filaments to the velum palati, tonsil, and soft parts of the palate and gums.

The *middle palatine* descends parallel with the former, in a distinct canal, and is distributed to the soft palate and tonsil.

The *small palatine*, posterior to the two others, supplies the tonsil and soft palate.

The *internal*, or spheno-palatine, passes into the nasal fossæ, through the spheno-palatine foramen, by three or four filaments. They ramify upon the spongy bones, but one branch passes down upon the septum of the nose, runs through the ductus incisivus into the anterior palatine foramen, and communicates with Cloquet's ganglion. It is called the naso-palatine nerve, or nerve of Cotunnius.

The *posterior* branch is the *vidian*. It runs backwards through the vidian canal, and having reached the foramen lacerum medium divides into two branches, the *carotic* and *petrous*. The carotic branch runs down to the carotid artery, uniting with the plexus of this artery, and is thus connected with the first cervical ganglion; the petrous branch perforates the cartilage, filling up the foramen lacerum, and then runs beneath the dura mater, towards the foramen innominatum, which it enters; soon after its entrance it unites with the portio dura, and runs with it along the aqueduct of Fallopius to its inferior extremity, where it leaves it; it then perforates the petrous bone and gets into the tympanum, running between the long crus of the incus and handle of the malleus, hence called *chorda tympani*, and emerges at the fissura glasseri; it then descends to the inner side of the lower jaw, communicating with the gustatory, and is ultimately distributed to the submaxillary ganglion.

Cloquet's ganglion, or naso-palatine, is situate in the anterior palatine canal, or foramen. It

receives, superiorly, the naso-palatine nerve; inferiorly, a filament from the great palatine nerve; and sends two or three twigs to the mucous membrane, on the anterior surface of the hard palate.

The submaxillary ganglion, or plexus, is small, and has a plexiform appearance. It rests upon the submaxillary gland. It communicates with the following nerves:

Posteriorly, with the vidian.
Superiorly, with the gustatory.
Inferiorly, it gives off filaments to accompany the Whartonian duct.

The *otic* ganglion, first minutely described by Arnold, is seated at the base of the skull, very near to the foramen ovale, and to the inner side of the third division of the fifth pair; internal to it is the Eustachian tube, and circumflexus palati; posteriorly, the middle meningeal artery. It communicates, by small filaments, with

the third division of the fifth pair, at its exit from the foramen ovale;
the pterygoid nerve;
the tympanic branch of the glosso-pharyngeal nerve, by a minute petrous twig.

It appears to give off

a filament to the tensor tympani muscle;
to the tensor palati;
to the anterior auricular nerve.

The *ganglion* of *Ribes* is situated upon the arteria communicans, receiving filaments from the carotic plexus. Its existence is disputed by many.

The *superior cervical ganglion* extends from the foramen magnum to the second or third cer-

vical vertebra, generally more than an inch in length; it is oblong in its figure, and of considerable size. The branches from it are the following:

Ascending, to communicate with the carotic plexus in the carotic canal.
External, to the cervical nerves.
Internal, to the pharynx, entering into the pharyngeal plexus.
Anterior, to unite with the par vagum, glosso-pharyngeal, lingual and facial nerves, and filaments named nervi molles, which accompany some of the branches of the external carotid; namely, the superior thyroid, lingual, labial, and ascending pharyngeal.
Descending, to the second ganglion: and filaments to form the superficialis cordis.

The *middle cervical ganglion* is very small, and sometimes wanting on the left side. Its situation is upon the fifth cervical vertebra. It gives filaments to the superior and inferior ganglia, to the cervical nerves, the thyroid gland, superior thyroid artery, and parts adjacent, and sends off the middle cardiac nerve.

The *inferior cervical ganglion* lies upon the transverse process of the last cervical vertebra, and neck of the first rib, behind the vertebral artery. It gives off filaments to the middle cervical and superior thoracic ganglia, branches to unite with the axillary plexus, filaments to accompany the vertebral artery, which form the vertebral plexus, and run up as far as the base of the skull, communicating in their course with all the cervical nerves: it gives also filaments to the pulmonary plexus, and sends off the inferior cardiac nerve.

The *cardiac* plexus, destined for the supply of

the heart, is formed by the cardiac nerves of the cervical ganglia, and branches from the nervus vagus and recurrent nerves. It is placed around the aorta, the greater portion being somewhat above it, and between it and the trachea; the other portion just below the arch, and rather on its anterior aspect, resting somewhat upon the pulmonary artery. This portion has been named cardiac ganglion. The branches from this plexus are the following:

Some going to the pulmonary plexus;
Some to the anterior part of the aorta;
Many follow the course of the coronary arteries, and are called coronary plexuses; namely, right, or anterior, and left, or posterior. They follow the arteries, and send filaments into the substance of the heart.

The *thoracic* ganglia, twelve in number, lie upon the heads of the ribs, and are connected together by one or two small filaments; they then give off branches to unite with the intercostal nerves. The superior five ganglia give off anterior filaments to the trachea, œsophagus, and aorta, and contribute to form the pulmonary, cardiac, and thoracic plexuses. The anterior branches, from the sixth to the ninth, inclusive, unite to form the splanchnicus major; and similar branches from the tenth and eleventh ganglia, form the splanchnicus minor. These nerves descend by the side of the vertebræ, pierce the crura of the diaphragm separately, and enter the abdomen. The splanchnicus major passes to the semilunar ganglion of each side, and the splanchnicus minor, to the renal plexus.

The *semilunar* ganglion of each side is situated close to the cœliac axis, around which the fibres

interlace, and with filaments from the nervus vagus, phrenic, and splanchnicus minor, constitute the great solar plexus. From this, branches pass off to accompany the contiguous arteries, and are named so many plexuses: they are,

Phrenic, to the crura, and broad part of the diaphragm running with the arteries.

The *coronary*, or *stomachic*, accompany the coronary artery to the stomach, distributed upon both its surfaces.

The *hepatic* plexus, accompanying the vessels into the transverse fissure of the liver; some of its filaments pass to the pylorus, others along with the gastro-duodenal artery. This plexus unites with filaments from the nervus vagus.

The *splenic* plexus, accompanying the splenic artery, and sending filaments with the vasa brevia to the great end of the stomach.

The *aortic* plexus, a continuation, as it were, of the solar plexus upon the aorta, with branches from the lumbar ganglia, may be said to send off the *superior* and *inferior mesenteric plexuses*, to accompany the corresponding arteries.

The *splanchnicus minor*, with other filaments from the sympathetic, forms the renal plexus, which sends numerous filaments into the kidney, with the arterial branches; and gives off inferiorly some filaments to accompany the spermatic artery, and which constitute the spermatic plexus.

In the abdomen we find the *lumbar* ganglia, four or five in number, by the sides of the lumbar vertebra, and to the inner edge of the psoas muscle. They are connected together by filaments, and are connected with the lumbar nerves and plexus, and send filaments anteriorly to the aorta, which enter into the composition of the abdominal, aortic, and lumbar plexuses.

The *sacral ganglia* are four or five on each side, with an azygos terminating one; they unite together by filaments, and communicate with the contiguous spinal nerves. Anterior filaments from

them, and also from the lowest lumbar ganglion, form the hypogastric plexus, which supplies nerves to the adjacent viscera; viz., the bladder, vesiculæ seminales, uterus, vagina, and rectum.

THE EYE.

The eye is placed within a bony cavity named the orbit.

Each *orbit* is formed by seven bones; and as three of them are common to both orbits, there are eleven bones only entering into the two. The orbit is pyramidal in form, with the base anteriorly, and directed a little outwards; the apex backwards and inwards. Probes passed through the axis of each orbit, into the cranium, will pass through the foramen lacerum orbitale superius, and meet upon the sella turcica. The roof of the orbit is formed by the frontal and ala minor of the sphenoid bone; the floor by the malar, superior maxillary, and palate bone; the outer wall by the malar and sphenoid; and the inner wall by the nasal process of the superior maxillary, the ethmoid, and frontal bones.

The orbit contains the globe of the eye, with numerous nerves, vessels, fat, and part of the lacrymal apparatus.

In dissecting the orbit, and removing its roof, the nerves will be found in the following order:

Fourth pair.
Frontal of the fifth.
Superior division of the third.
External to these, and nearly on the same plane, the lacrymal of the fifth.
Inferior division of the third.
The sixth pair, lowest.

The trunk of the ophthalmic artery, at first below and to the outer side of the optic nerve, soon after crosses over, to get to its inner side. The ophthalmic vein is situated below all the nerves.

There are certain appendages of the eye which require to be described at the same time: they are the eyebrows, eyelids, and part of the lacrymal organs.

The *eyebrows* consist of the integuments covering the supraorbital ridge of the frontal bone on each side. They contain adipose tissue and fibres of the occipito-frontalis and corrugator supercilii muscles, and are studded with hairs, extending in an arched direction from near the root of the nose to a little beyond the outer canthus of the eye.

The *eyelids* are two thin curtains covering the eye, and are superior and inferior. They consist of common integument externally, of mucous membrane internally, containing between them some very loose cellular tissue, which causes the lids to swell very rapidly from any effusion of blood or serum; the orbicularis palpebrarum; the tarsal cartilages; and, in the upper lid, fibres of the levator palpebræ superioris. Their points of union are called the external and internal canthus. Along the internal surface, near their edges, are numerous glandular bodies, called the meibomian glands or follicles, and at their margins a row of stiff hairs, called cilia or eyelashes. Near the internal commissure there are angular projections, each presenting a little orifice, named punctum lacrymale. These are surrounded by a fibro-cartilaginous ring, which serves to keep

them patulous, and to allow the tears to pass from the surface of the eye into the lacrymal sac.

The tarsal fibro-cartilages differ in the two lids. The upper one is semilunar in form, with its convex thin edge uppermost; it is kept in its place by palpebral ligaments, connecting it internally with the tendo-oculi, superiorly and externally with the periosteum of the orbit. The lower fibro-cartilage is smaller, and of nearly equal thickness in its whole length, and is attached at its extremities like the upper one.

The *meibomian glands*, or sebaceous follicles, are more numerous in the upper than under eyelid: in the upper one there are about forty; in the lower one, half the number. They are arranged in vertical rows, and open at the edges of the lids. The secreted matter from them prevents the eyelids from sticking together, and in some measure prevents the tears from escaping over the edges of the lids.

Near the internal canthus are also seen two other bodies, the plica semilunaris and the caruncula lacrymalis.

The *plica*, or *valvula semilunaris*, is a fold of mucous membrane of a triangular form; its base is concave towards the centre of the eye, its apex pointing to the inner canthus; it appears like a third eyelid, or rudiment of the membrana nictitans in the owl, eagle, &c.

The *caruncula lachrymalis* is a small fleshy body of a red colour, composed chiefly of mucous follicles, studded with small hairs on its surface.

The lacrymal apparatus consists of the lacrymal gland and tubes, the puncta and lacrymal canals, the lacrymal sac, and nasal duct.

The *lacrymal gland* is situated at the upper and outer part of the orbit, resting against the lacrymal fossa of the frontal bone; it is from half an inch to an inch long and about half an inch broad, composed of two lobes, consisting of a number of lobules like a conglomerate gland; from it seven or eight little tubes proceed, which open on the under surface of the upper eyelid, near the external canthus. The tears then pass along the surface of the eye towards the puncta lachrymalia, which they enter, and from which two canals are extended to the lacrymal sac.

The canals leading into the sac differ in their direction; the upper one forms an angle in its middle course, looking upwards; the lower one is nearly straight, and if curved, it is so downwards; they are thus concave towards each other, and open almost by a single aperture into the sac.

The *lacrymal sac* is an elongated reservoir, situated behind the palpebral ligament, in a fossa formed by the os unguis and the nasal process of the superior maxillary bone, opening inferiorly into the nasal duct. It is lined by mucous membrane, and by a thin fibrous layer forming a periosteum.

The *nasal duct*, a continuation of the lacrymal sac of the nose to the inferior meatus, is about half an inch in length. Its direction is downwards, backwards, and outwards. Its bony parietes are the os unguis, the superior maxillary bone, and the inferior spongy bone. It opens into the inferior meatus of the nose, having a fold of mucous membrane in front of it.

The *globe* or *ball* of the eye is composed of *membranes* or *coats*, *humours*, *vessels*, and *nerves*.

The *membranes* of the eye are the *tunica conjunctiva*, *sclerotica*, *choroidea*, *cornea*, *iris*, *retina*, the *hyaloid*, *capsule* of the *lens*, and *membrane* of the aqueous humour.

The *tunica conjunctiva* is a delicate mucous membrane reflected over the anterior third of the globe of the eye, and lining the internal parts of the eyelids; it is a continuation of the skin, and also of the mucous membrane of the nasal fossæ; it is most vascular where it lines the lids, less so upon the sclerotica, and least upon the cornea.

The *sclerotic coat*, so named from its hardness, is fibrous in structure, and continuous with the dura mater, through the medium of the optic nerve, covering about four-fifths of the globe of the eye; it is thickest posteriorly, thinner at the sides, but thick again where it unites with the cornea; externally, it is in apposition with the muscles, vessels, lacrymal gland and nerves; internally, with the choroid coat. It is perforated laterally by the ciliary nerves and vessels; and posteriorly, internally, and inferiorly, to the axis of the eye, by the optic nerve, which enters by several orifices in a cribriform manner. The tendinous expansion of the recti muscles upon the anterior part of the sclerotica has obtained the name of *tunica albuginea*.

The *cornea* is the transparent covering in front of the eye, about six lines in diameter, but which is slightly greater in the transverse direction; by its outer margin, which is bevelled off only in front, it is attached to the sclerotica, which slightly overlaps it, on account of which anatomists say that the cornea fits into the sclerotica, like a glass into a watch-case: externally, it is

covered by the conjunctiva: internally, it is in contact with the membrane of the aqueous humour. It is convex anteriorly, concave posteriorly, and composed of several lamellæ connected by cellular substance, with a thin serous fluid between them.

The *choroid membrane*, situated between the sclerotica and retina, is essentially vascular. It extends from the optic nerve to the ciliary ligament; near its anterior margin, it is thrown into folds or processes, which lie upon the edge of the lens and anterior portion of the vitreous humour: these are called ciliary striæ, or processes. On its outer surface are seen the ciliary nerves and long arteries; next to them the veins of the choroid, called vasa vorticosa; internally to them the short ciliary arteries, which, by subdividing, form a beautiful network, named tunica Ruyschiana, which secretes on its inner surface the pigmentum nigrum, in some animals termed the tapetum.

The *ciliary striæ*, or processes, are very numerous, from seventy to eighty in number, alternately long and short, and conjointly named corpus ciliare. They are somewhat triangular in shape, and having pigmentum nigrum deposited between them, when removed from the vitreous humour, they leave a radiated appearance.

The *retina*, as it is termed, consists of three membranes, the outer of which, in apposition with the choroid, is the tunica Jacobi; the middle one, the real expansion of the optic nerve, the tunica nervosa; the inner one is the tunica vasculosa retinæ. The extent of the retina anteriorly is not quite clear, some say, and amongst them Cruveilhier, that it only proceeds as far as the

posterior edges of the ciliary striæ; others, that it passes as far as the crystalline lens.

The *tunica Jacobi* is an extremely delicate serous membrane, composed of two layers, according to the researches of Mr. Dalrymple, and forming a shut sac.

The *tunica nervosa*, the expansion of the optic nerve, is pulpy, and terminates at the edge of the ciliary processes.

The *tunica vasculosa* contains several minute branches from the arteria centralis retinæ.

In the centre of the back part of the retina, in the axis of the globe of the eye, a yellow spot is observed, called the limbus luteus, with a fancied orifice, called foramen centrale of Sömmering. This is produced by a deposit of yellow substance; and the membrane being puckered up into a fold, causes the appearance of a dark spot or orifice in the centre.

The *iris* is a circular membrane, attached by its outer border to the ciliary ligament, with a central orifice, called the pupil. Its anterior surface is coloured variously in different individuals; its inner surface is lined with a substance resembling pigmentum nigrum, named the *uvea*. It separates the cornea from the lens. In structure it appears to be fibrous, and, according to some, muscular. On the anterior surface two circles may be observed, the external one, named *annulus major*, is paler, and consists of fibres radiating from the circumference towards the centre; the inner fibres run circularly and form the *annulus minor*. On the posterior surface of the iris, the fibres pass straight from the circumference towards the pupillary margin.

The pupil of the fœtus, up to nearly the seventh month, is filled up by a membrane called the membrana pupillaris; this is supposed to be formed by a meeting of the membranes lining the two chambers of the eye, but seems more like a continuation of iris, which is afterwards absorbed, in consequence of the pressure produced by the evolution and growth of the lens.

The space between the anterior surface of the iris and the cornea is called the *anterior chamber of the eye.* It is lined with a membrane which secretes the aqueous humour. A similar space exists between the posterior surface of the iris and lens, termed posterior chamber. The anterior chamber is about a fifth larger than the posterior.

The iris is supplied with blood by the long, short, and anterior ciliary arteries: by meeting and anastomosing at the external part of the iris, they form the *larger arterial circle;* and again, by anastomosing near the pupillary margin, they constitute the *circulus arteriosus minor*: its nerves are derived from the lenticular ganglion and nasal branch of the fifth; its veins empty themselves into the vasa vorticosa.

The external edge of the iris, by uniting with the choroid and sclerotic coats, forms a greyish circle, named the ciliary circle or ligament. The ciliary ligament is described by some as formed by the union of the cornea, choroid, and sclerotic coats. From its grey pulpy appearance and nerves terminating in it, some have supposed it to be a nervous ganglion.

Between the ciliary ligament and sclerotic coat, a narrow circular canal may be found, called the canal of Fontana.

HUMOURS OF THE EYE.

The aqueous humour contained within the anterior and posterior chambers is secreted by its proper membrane. In quantity it is about three drops; its use is to properly distend the cornea, to allow free motion of the iris, and to act on the direction of the rays of light as they pass through it.

The *crystalline lens* is a transparent body, situate behind the iris, and in front of but partially imbedded in the vitreous humour. It is composed of concentric lamellæ, softest on the outside, and contained in a capsule, between which and the lens, is a little fluid named the liquor Morgagni.

It is doubly convex: the anterior portion represents a small segment of a large sphere; the posterior one a larger segment of a smaller sphere, consequently it is most convex posteriorly. It is also covered by the hyaloid membrane, which, at its edge separates into two layers, of which one passes in front, the other behind the lens. By this separation a space is left at the edge of the lens, known as the canal of Petit; when inflated by a blowpipe it has a vesicular appearance.

The vitreous humour, or *corpus vitreum*, which fills up the two posterior thirds of the eye, is perfectly transparent. It is contained in a number of cells, formed by processes of the hyaloid membrane, which also gives it a general covering. It is penetrated by branches of the arteria centralis retinæ, and is excavated anteriorly for the lodgement of the crystalline lens.

THE EAR.

The ear, as commonly understood, consists of external and internal parts.

The parts of the external ear are the auricula and external auditory passage, or meatus; the parts of the internal ear are the tympanum and labyrinth.

The *auricula*, or outer ear, is composed of common integument, fibro-cartilages, muscular fibres, vessels, and nerves. The upper expanded portion is named the *pinna*, the lower small part the *lobe* or *lobule*, which is devoid of fibro-cartilage and muscle.

The prominent ridge forming the outer part of the pinna is named the *helix;* the bifid projection within it is named *antihelix;* the nipple-shaped prominence just in front of the meatus externus is the *tragus;* a small one behind and opposite to it the *antitragus*. The depression, or groove, between the helix and antihelix is the *fossa innominata*, that between the ridges of the antihelix is the *fossa navicularis*, and the deep fossa below it is the *concha*. The posterior surface of the concha is called the *dorsum* of the ear.

The outer ear is kept in its situation by fibrous bands, which attach it to the zygoma, the mastoid process, and temporal aponeurosis. It is moved by three muscles, the *anterior auris*, *retrahentes*, and *attollens aurem*. There are also delicate muscles proper to the pinna of the ear, for the motion of separate parts, but so small as to be discovered

with some difficulty; they are rudiments of like parts found in animals, and are the following:

Helicis major.
.....minor.
Tragicus.
Antitragicus.
Transversus auriculæ.

And two others described by Mr. Tod, viz.:

Obliquus auris.
Contractor meatus.

The meatus *auditorius externus*, or external auditory passage, extends from the concha to the membrana tympani. It is partly formed of cartilage and integument, partly of the latter and bone. The lining integument is also reflected upon the membrana tympani. Its direction is inwards and slightly forwards, arching a little superiorly, thus presenting a slight concave direction inferiorly. Its length is about an inch, but is somewhat longer inferiorly in consequence of the oblique position of the membrana tympani. Its broadest part is external, the narrowest in the middle. The integument lining this meatus is studded with a number of ceruminous glands, which secrete the peculiar thick fluid called wax of the ear, and at the outer part with a number of hairs.

This passage is separated from the internal ear by the membrana tympani.

The *membrana tympani* is nearly circular, attached by its circumference to a bony ring. It consists of three layers, the outer one a continuation of the common integument, the inner one continuous with the mucous membrane of the tympanum; the middle one is fibrous, and is the proper membrane. Its fibres converge from the

circumference to the centre. It is concave externally, convex internally. Its direction is oblique, as it looks downwards, outwards, and forwards; to the centre of it internally, the long handle of the malleus is attached.

The *tympanum*, or drum of the ear is a narrow cavity, lined with mucous membrane, continuous with that from the Eustachian tube, bounded externally by the membrana tympani, posteriorly by the mastoid process and cells, and internally by the labyrinth. On its inner wall, about the centre, a prominence is seen called the *promontory;* above this is a foramen, closed by membrane in the recent state, named *fenestra ovalis*, which communicates with the vestibule. Below the promontory, and more concealed by it, is a round aperture, likewise closed in the recent state by membrane, called *fenestra rotunda;* it is in relation with the scala tympani. Along the posterior wall, behind the promontory, we find a little bony projection, named the pyramid: it presents a little orifice at its apex, which transmits the tendon of the stapedius muscle, the body of which is lodged in the bone; beneath this, and behind it, is a little foramen, which transmits the chorda tympani; superiorly and posteriorly is the opening from the mastoid cells.

Along the anterior part of the tympani we meet with the glenoid fissure, which gives lodgement to the processus gracilis of the malleus, and passage to the chorda tympani and tendon of the laxator tympani muscle, a minute artery and vein. Anteriorly and internally we observe the orifices for the Eustachian tube, and tensor tympani muscle.

Within the tympanum is a chain of small bones, named *ossicula auditus*. They are the malleus, incus, orbiculare, and stapes.

The *malleus*, (a hammer), in relation with the membrana tympani, consists of a head, neck, and processes. The *head* articulates with the incus; the *neck* is between this and the processes; the *manubrium* (handle) is a long process, connected by its extremity with the membrana tympani. The processus brevis is external, passes from the neck at a right angle, and rests against the membrana tympani. The processus gracilis proceeds from the neck, forwards and downwards, and is inserted by its point into the glenoid fissure. The *incus* (an anvil) may be divided into a body and processes. The body is anterior, and is articulated at its upper part with the head of the malleus. Its short crus, or process, is directed backwards, and retires into the mastoid cells; its long process, or crus, passes forwards, downwards, and inwards, terminating in a rounded point, which has been named as a separate bone, the *os orbiculare*, by which it is articulated with the stapes.

The *stapes* (a stirrup) is said to consist of a base, processes, a neck and head. The *head* is articulated with the incus; the *neck* has the stapedius muscle attached to it; the *processes* pass from the neck to the base, and have a delicate membrane filling up the space between them; the *base*, of an oval form, fills up or occupies the opening named *fenestra ovalis*.

These bones admit of some motion, which is influenced by some minute muscles, the smallest in the body. They are four in number:

The *Tensor tympani*,

Or. upper surface of the cartilage of the Eustachian tube and petrous bone.
Ins. the processus brevis of the malleus.

Laxator tympani,

Or. spinous process of sphenoid bone.
Ins. processus gracilis of the malleus.

Laxator tympani minor,

Or. the bony circumference of the membrana tympani.
Ins. manubrium of malleus, near the short process.

Stapedius,

Or. tube of the pyramid.
Ins. neck of the stapes.

The *Eustachian tube* is partly formed of bone and partly of cartilage. The cartilaginous portion forms about two thirds of it. It is narrowest about the middle third, broadest at its anterior part. Its direction from the ear is forwards, inwards, and a little downwards. It opens opposite the posterior part of the inferior spongy bone. The bony portion is separated from the tensor tympani muscle by a thin bony partition, called *processus cochleariformis*. The cartilage does not completely surround the tube, it is deficient at the inferior external part, which is filled up by a fibrous substance.

The *labyrinth* consists of the vestibule cochlea and semicircular canals. It is lined with a delicate membrane, which is bathed by a thin fluid named aqua labyrinthi, and contains the ramifications and expansions of the auditory nerve, thus constituting the principal part of the organ of hearing.

The *vestibule* is a cavity somewhat larger than

a grain of pearl barley. It is nearly filled with the expansion of the portio mollis, is lined with a delicate membrane, between which and the nerve is the liquor Cotunnii. Its boundaries are:

Anteriorly, the cochlea.
Posteriorly, the semicircular canals.
Internally, the lamina cribrosa, for the portio mollis.
Externally, the osseous plate forming the promontory.
Superiorly, the bone, containing the aqueduct of Fallopius.

The openings into it in the dry bone are the fenestra ovalis, externally; five openings from the semicircular canals, posteriorly; one from the scala vestibuli, anteriorly; the foramina for the auditory nerve, internally; and from the posterior and external part a foramen which transmits a small vein, and is named aquæductus vestibuli.

The *cochlea* is situated in front of the vestibule, in the hardest portion of the petrous bone. It is named from its resemblance to the spiral tubes of a shell. It may be described as a spiral bony tube, which makes two turns and a half round an axis or pillar, named modiolus. This tube is separated, by a delicate lamella in the recent state, into two distinct tubes, which are named the scala tympani (the staircase of the tympanum), and scala vestibuli, in consequence of one opening into the vestibule, the other communicating with the tympanum at the fenestra rotunda, with the intervention of a delicate membrane. The lamella is formed of bone towards the modiolus, and does not quite extend to the top of the tube, the rest is membranous, and extends as far as the cupola, which is the extreme point where the two scala communicate.

The base of the modiolus is opposite to the

entrance of the portio mollis from the internal auditory meatus, and is here perforated for the little nervous filaments and vessels: the passage in the modiolus expanding at the top is called the infundibulum.

Near to the point where the scala tympani communicates with the fenestra rotunda, a small foramen exists, which transmits a vein, and is named *aquæductus cochleæ.* It opens into the lateral sinus near the jugular fossa.

The *semicircular* canals are three in number, and, from their direction, are named superior or *vertical,* external or *horizontal,* and posterior or *oblique;* they are situated in the petrous bone, not so deeply embedded as the cochlea, and each of them forms rather more than half a circle; they are lined with a delicate membrane, and contain the pulpy expansion of the portio mollis, with a little fluid intervening between the nerve and the canals. They open by each extremity into the vestibule; but, as the vertical and posterior canals unite together by their contiguous extremities before communicating with the vestibule, there are only five, instead of six, openings.

The *meatus auditorius internus,* is a bony canal in the posterior surface of the pars petrosa, giving passage to the portio mollis, portio dura, and an artery, which runs somewhat between the two nerves. At the bottom of this canal a little bony ridge is seen, separating it into two parts, the superior smaller, and the inferior cribriform plate. Through the upper opening the portio dura passes; through the lower the portio mollis and the artery.

The superior passage, or tube, is the aqueduct

of Fallopius ; it passes upwards and outwards, then downwards and outwards, and then backwards and downwards ; at first above the cochlea, then runs over the roof of the tympanum and terminates at the foramen stylo-mastoideum. It conveys the vidian nerve and portio dura, which in its course gives filaments to pierce the bone, and supply the tensor tympani and stapedius muscles.

The auditory nerve at the bottom of the meatus divides into numerous filaments ; some pass into the foramina of the modiolus, and in their passage perforate its walls, and arrive at the lamina spiralis, and walls of the scala, upon which they are spread out in the most delicate manner. A second set in the vestibule expand almost to fill up this cavity, and receive an investment from its membrane, which has been named sacculus vestibuli. The third series mount up over the former, and enter the semicircular canals. On entering them, the nerves appear to expand into a pulpy mass, which almost fills up the tubes ; they are supported by the liquor cotunnii. The vidian nerve is said by some anatomists to supply motor filaments to all the muscles of the internal ear. The arteries, which are very delicate, are, first, the branch from the basilar or posterior cerebral, which enters by the lamina cribrosa, and ramifies in the labyrinth ; second, a *stylo-mastoid* branch from the posterior auricular, enters the tympanum, supplies minute branches to it, the mastoid cells and labyrinth sometimes forming an arterial circle round the membrana tympani by uniting with the artery which enters by the fissura glasseri ; third, the tympanic branch given off from the internal

maxillary artery, it enters through the fissura glasseri, ramifies in the tympanum, and anastomoses freely with the stylo-mastoid branch. The veins corresponding with the last-named arteries take a similar course; but those of the labyrinth terminate in the (improperly named) aqueducts of the vestibule and cochlea, which convey the blood to the lateral sinuses.

THE NOSE.

The bones which enter into the formation of the nose are fourteen in number, consisting of all the bones of the face, excepting the two malar and inferior maxillary, and three bones which are described as common to the head and face, viz. the frontal, ethmoid, and sphenoid. By a central partition, the nose is divided into two distinct fossæ. This septum of the nose is formed by the vomer, nasal lamella of the ethmoid bone, and an extensive cartilage. The roof of the nose has a flattened surface in the centre, shelving down anteriorly and posteriorly. It is bounded anteriorly by the nasal bones, superiorly by the frontal bone and cribriform plate of the ethmoid bone, and posteriorly by the body of the sphenoid. The floor is formed by the superior maxillary and palate bone, and the outer wall by the ethmoid, internal pterygoid plates, os unguis, inferior spongy bone, palate bone, and superior maxillary. The inner wall is the septum.

Each nostril is divided into chambers by the spongy bones. These chambers are named *superior, middle,* and *inferior.* The openings into

these, in addition to the anterior and posterior common openings, or nares, are the following: in the *inferior* meatus is the opening from the nasal duct, concealed by a fold of mucous membrane. In passing a probe into it, the instrument must be curved and carried just beyond the fold, and then, by turning it outwards and backwards, it may be made to enter the duct.

The openings into the *middle* meatus are: one from the maxillary sinus, one from the frontal sinus and anterior ethmoidal cells. In the superior meatus we find the opening from the posterior ethmoidal cells and sphenoidal sinuses; and, in the dry bones, the spheno-palatine foramen. At the anterior part of the floor, on each side, in the dry bone, is the superior orifice of the anterior palatine canal.

The *Eustachian tube* might almost be said to enter the nares. Its anterior aperture corresponds with the posterior part of the inferior spongy bone; when a probe has to be introduced into it, it should be carried immediately under the inferior spongy bone, and when it has arrived at the extremity of that bone it should be guided a little outwards.

The posterior nares, or apertures, are oblong in the perpendicular direction, compressed laterally; bounded above by the sphenoid bone; externally, by the internal pterygoid plates; internally, by the vomer; and inferiorly by the palate bone.

The mucous membrane of the nose is named *pituitary*, or *schneiderian*, it is continuous with the common integument anteriorly, and with the mucous membrane of the pharynx posteriorly; it is red, soft, and villous, especially about the

spongy bones; anteriorly smoother and studded with hairs, and exceedingly adherent to the periosteum; but, in the cells and maxillary sinus, it is thin, very pale, and slightly adherent to the bones.

The softer anterior part, consisting of the alæ and tip of the nose, is formed of common integument and cartilages: these are five in number, one central and two lateral on each side: the anterior one, elongated from above downwards, is somewhat triangular in shape, broadest superiorly, where it is attached to the perpendicular plate of the ethmoid bone. Of the lateral cartilages, the superior one is triangular, and attached to the nasal and superior maxillary bones, and anteriorly rests against the perpendicular cartilage: the inferior lateral cartilages, most particularly, give form to the alæ nasi. They are arched and convex externally; connected above with the superior lateral cartilage, externally to the superior maxillary bone, and anteriorly are loosely connected with the perpendicular cartilage. In addition to these five, there are some smaller cartilages, which are uncertain as to number, and not definite in their form.

The arteries of the nose are derived from the labial, internal maxillary and ethmoidal. The nerves are branches of the olfactory, or first pair, the nasal division of the fifth and Meckel's ganglion.

THE MOUTH, PHARYNX, AND ŒSOPHAGUS.

The bony parts of the mouth are the superior and inferior maxillary, the palate bones, and the teeth.

The first teeth in the child are temporary, and are usually twenty in number. About the seventh or eighth year they are replaced by the permanent teeth, which, when complete, are thirty-two in number.

The teeth of a child, that is, the first set in each jaw, are four incisores, two cuspidati or canini, and four molares.

In each jaw of the adult there are four *incisores*, two *cuspidati* or *canini*, four *bicuspidati*, and six *molares*. The posterior molares, which protrude often late in life, have been named *dentes sapientiæ*. The first, or anterior molares, are the earliest of the permanent teeth which show themselves above the gums.

The soft parts of the mouth are, the cheeks and lips, the gums, the soft palate and uvula, the tongue, the lining membrane, and salivary glands.

The cheeks and lips are formed by common integument and muscle, and are studded with glands, named buccal and labial, which secrete fluid very like saliva.

The soft palate is the loose fleshy curtain which hangs down from the palate bones, forming a partition between the mouth and the pharynx, and consists of five muscles, enclosed in a mucous membrane. There is a small fleshy substance projecting from its centre, called the *uvula*, from which two folds of membrane diverge, forming the *anterior* and *posterior arches* of the *palate*. The former passes to the side of the tongue, the latter to the pharynx. In the triangular space between them is a glandular body, named the *amygdala* or *tonsil*.

The *tonsils* consist of an aggregation of follicles,

which secrete a thick mucus. They are bounded by the palato-glossus, anteriorly; the palato-pharyngeus, posteriorly; the stylo-glossus muscle, inferiorly; and the mucous membrae, internally.

The muscles of the soft palate are, the *levator palati*, the *circumflexus*, or *tensor palati*, the *azygos uvulæ*, the *palato-glossus*, or *constrictor isthmi faucium*, contained in the anterior arch, and the *palato-pharyngeus*, imbedded in the posterior arch.

The *uvula*, which hangs down from the centre of the anterior arches of the palate, consists of mucous membrane surrounding muscular fibres, named the *azygos*, or *levatores uvulæ*.

The opening from the mouth into the pharynx, also named *isthmus faucium*, is bounded superiorly by the velum pendulum palati, laterally by the tonsils and arches of the palate, and inferiorly by the tongue.

The *tongue* may be divided into a base, body, and apex. By its base it is attached to the os hyoides; its superior surface is ordinarily convex, and divided by an imperfect central depression into two symmetrical halves. It is composed of muscles, and adipose substance, and numerous vessels and nerves.

The muscles entering into the formation of the substance of the tongue are, the *genio-hyoglossus*, the *hyoglossus*, *lingualis*, and the *styloglossus*, and are in this order, externally the styloglossus, then the hyoglossus, then lingualis, and nearest to the mesian line, the genio-hyoglossus. Some of the fibres of the lingualis are also seen between the styloglossus and hyoglossus.

Some of the fibres of these muscles take a trans-

verse direction in the tongue, and there are others which seem to pass almost perpendicularly from one surface to the other, and are so complexly intermingled that it is difficult to assign them to any of the lingual muscles just enumerated.

The arterial ramifications are from the lingual artery.

It receives nerves from the gustatory branch of the fifth pair, the glosso-pharyngeus, and the ninth pair, or lingual nerve.

On its surface are seen numerous papillæ, which are named from their different forms. Thus, they are called *lenticulares*, near the base of the dorsum of the tongue, about fifteen to eighteen in number, placed in rows and converging to a point, anterior to the depression, named foramen cæcum; *fungiformes* or *capitatæ*, at the sides and tip of the tongue; and *pyramidales* or *conicæ*, distributed over the entire surface of the tongue. The last two kinds contain terminating filaments of the gustatory nerve.

Near the base of the tongue, on its dorsum, a round depression is seen, called the foramen cæcum. Several mucous follicles empty themselves into it.

The under surface of the tongue is free only at its anterior third, the rest being attached to the lower jaw and muscle by a fold of membrane named *frænum linguæ*. Along the sides of it the ranine veins are very conspicuous.

The *salivary glands* are, the *parotid*, *sublingual*, and *submaxillary*, on each side.

The *parotid gland*, so named from its situation near the ear, is bounded,

Anteriorly,	by the ramus of the jaw.
Posteriorly,	by the mastoid process and external auditory meatus.
Internally,	by the styloid process and its muscles.
Externally,	by fascia, fibres of the platysma, and integuments.
Superiorly,	by the zygoma.
Inferiorly,	by the angle of the jaw and digastric muscle.

It surrounds within its substance the external carotid artery, with the roots of the temporal, internal maxillary and transverse facial branches, the temporal and internal maxillary vein, the portio dura, auricular nerve of the cervical plexus, auricular branch of the fifth pair of nerves, and some lymphatic glands. Internal to the styloid muscles and this gland we find the internal carotid artery and internal jugular vein.

The parotid is a conglomerate gland, and consists of a series of lobules, made distinct by the vessels and nerves, and partly by the fascia, which covers it externally, forming a species of capsule; one portion of it overlaps the masseter muscle, and has been named *socia parotidis*; a portion of it posteriorly and superiorly occupies part of the glenoid cavity. From these several lobes, little ducts converge to form the parotid or *stenonian duct.* This duct runs forwards upon the masseter muscle, nearly an inch below the zygoma, passes through a quantity of fat, which rests on the buccinator muscle, then perforates this muscle, and opens into the mouth, opposite about the second molar tooth. It consists of two coats, the lining one mucous, continuous with the membrane of the mouth, and an outer one, fibrous. It is narrowest in its centre, somewhat dilated at each extremity, and is accompanied by the transverse facial artery and

middle division of the nerves from the pes anserinus.

The *submaxillary gland* occupies part of the space between the lower jaw and digastric muscle. It is bounded above by the lower jaw, the mylo-hyoideus, and hyoglossus muscles; externally by the jaw, fascia of the neck, platysma, and common integuments; below by the digastric muscle. The facial artery grooves it, along its posterior part, and sometimes appears to separate it into two lobes.

Its structure is like that of the parotid.

The excretory duct, named Wharton's, passes obliquely upwards and inwards, parallel with the gustatory and lingual nerves. After passing between the mylo-hyoideus and hyoglossus muscles, it runs between the sublingual gland and genio-hyoglossus, immediately under the mucous membrane, along the frænum linguæ, as far as a prominent papilla, just behind the inferior incisor teeth, where it opens by an exceedingly small orifice.

The Whartonian duct has much thinner coats than the stenonian, its caliber is greater, and it is more dilateable; and when distended by fluid or calcareous matter, projects considerably into the cavity of the mouth.

The *sublingual gland* rests upon the sublingual fossa of the lower jaw, on each side of the symphysis; smaller than the other salivary glands. It is placed beneath the mucous membrane, lies upon the mylo-hyoid muscle, and rests against the lower jaw; internal to it is the genio-hyoglossus, from which it is separated by the gustatory nerve, Wharton's duct, and the ranine vein; anteriorly, it reaches the border of its fellow gland, at its pos-

terior edge it is embraced by the gustatory nerve, which supplies filaments to it.

The excretory ducts (ducts of Rivinus) are seven or eight in number; they open along the ridge on the side of the frænum linguæ. Some of them have been found to pass into the Whartonian duct.

These salivary glands are so placed that, by the action of mastication, they should be exposed to pressure, which will force out the fluid at the time when it is most required.

The *pharynx* is a musculo-membranous bag, somewhat of the shape of a funnel; it is broadest about its middle, more constricted superiorly, but most so inferiorly, where it terminates in the œsophagus.

It is bounded posteriorly by the cervical vertebræ: superiorly, by the base of the skull; laterally, by the large vessels of the neck, and by muscles; anteriorly, by the soft palate, tongue, glottis, and larynx; inferiorly, it terminates in the œsophagus, opposite the fifth cervical vertebra.

Internally it consists of mucous membrane, on the outside of which are the muscles which chiefly form its parietes. They are the *superior*, *middle*, and *inferior constrictors* of each side; accessory to them are the *stylo-pharyngeus* and *palato-pharyngeus*. In addition to these parts, Cruveilhier describes a membranous or aponeurotic layer, which consists of two portions, named cephalo-pharyngeal and petro-pharyngeal. Posteriorly it serves as a point of attachment to the pharyngeal muscles.

There are seven openings into it, viz. two from the posterior nares, two into the Eustachian tubes,

one into the mouth, one into the larnyx, and the seventh into the œsophagus.

The *œsophagus* is a cylindrical tube, the narrowest portion of the alimentary canal, extending from the pharynx to the stomach, from about the fifth cervical vertebra to opposite the tenth dorsal. It is at first placed behind the trachea; in the chest it is inclosed in the posterior mediastinum, rather to the right of the arch of the aorta; about the centre of the chest it inclines over the aorta, and lower down is in front, but a little to the left of it. It does not pass exactly in the mesian line, for its upper part, in the chest, is a little inclined to the right, and its lower part to the left side. It has two series of muscular fibres, circular internally and longitudinal externally, which are in some degree collected together, so as to form three fasciculi, one on each side, and one in front; it is lined internally by a mucous membrane, continuous from the mouth and pharnyx, also by a reflexion of epidermis, named epithelium, which extends as far as the cardiac orifice of the stomach.

It receives its blood from the inferior thyroid arteries in the neck, but in the thorax has arteries direct from the aorta. It is accompanied in most of its course by the par vagum, which, with the sympathetic in the upper part of the chest, forms a plexus around it, called œsophageal.

LARYNX, TRACHEA, AND BRONCHI.

The *larynx* is composed of cartilages, numerous ligaments, muscles and lining mucous mem-

brane, with its arteries, veins, nerves, and absorbents.

It is situated in the front and middle of the neck, anterior to the pharynx; connected with the os hyoides superiorly, with the trachea inferiorly, and bounded laterally by muscles and the large vessels of the neck.

It is nearly a third larger in the male than in the female.

The thyroid cartilage, which is the largest, is placed anteriorly. It is formed by two lateral portions of a quadrangular shape, united anteriorly at an obtuse angle, where they form a projection, termed pomum Adami, most prominent in the male. At its superior posterior angle, on each side, there is a projecting portion, named its superior cornu, which is attached by a lateral thyro-hyoid or round ligament to the os hyoides. There is frequently found in it a small portion of bony matter.

The inferior margin, convex in the centre, is connected by the crico-thyroid ligament to the cricoid cartilage. At the posterior inferior angle another projection is found, named the inferior cornu, which is connected with the cricoid cartilage by the lateral crico-thyroid ligament.

The cricoid cartilage is of the form of a ring, with its broadest or signet portion posteriorly. It lies beneath the thyroid cartilage, and above the first ring of the trachea. It is connected with the former by the crico-thyroid ligaments, and with the latter by a broad process of ligamentous substance.

Its superior margin inclines downwards and forwards, its inferior one is horizontal. On its posterior superior margin are observed four smooth articulating surfaces, the direction of which is up-

wards and outwards. The inner surface on each side receives the base of the arytenoid cartilages; the outer ones, the inferior cornua of the thyroid cartilage. The posterior surface of the cricoid is furrowed by the crico-arytenoidei postici muscles. In old age this cartilage is frequently ossified.

The *arytenoid* cartilages are two in number, of a pyramidal figure, attached at their base by capsular ligaments to the upper edge of the cricoid cartilage.

They have a little cartilaginous appendage on the summit, named *corniculum laryngis*, which is attached by ligaments and a synovial capsule.

Their posterior surface is a little hollowed out, for the insertion of the transverse and oblique arytenoid muscles.

To their anterior surface, which is rather convex, and to the apex, are attached ligamentous fibres, which pass to the inside of the projecting part of the thyroid cartilage, and to the epiglottis.

These cartilages are sometimes ossified.

The *epiglottis* in texture is not strictly cartilaginous; it belongs rather to the fibro-cartilaginous tissue, known by the French as *tissu jaune*.

It adheres inferiorly to the interior part of the thyroid cartilage by a strong elastic ligamentous substance.

It is somewhat oval, or is likened to an obcordate leaf, rather convex above, concave below, covered by mucous membrane, and studded with numerous mucous follicles.

It is kept in its situation also by ligaments, extending from the base of the tongue, and likewise by two ligaments, which proceed from its sides to the arytenoid cartilages.

The ligaments of the larynx are by some considered to be seventeen in number. They are, three broad, four capsular, two round, four thyro-arytenoid, and four connected with the epiglottis.

The broad ligaments are

The thyro-hyoid, connecting the upper edge of the thyroid cartilage with the internal surface of the os hyoides. It is also named thyro-hyoid membrane.
The crico-thyroid.
The ligamentous substance between the cricoid cartilage and the first ring of the trachea.

The capsular ligaments are four. They are on each side.

Crico-arytenoid,
Crico-thyroid.

The two round ligaments extend from the superior cornu of the thyroid cartilage to the os hyoides on each side.

The thyro-arytenoid ligaments are superior and inferior on each side. The inferior only are really ligamentous, and form the true chordæ vocales; they pass from the base of the arytenoid cartilages to the inside of the angle of the thyroid. The superior, so styled ligaments, are folds of mucous membrane, passing from near the apex of the arytenoid cartilages to the same point as the former. Between the two, on each side, is a fossa, named *sacculus laryngis*, or ventricle of Galen.

The four ligaments of the epiglottis are

Thyro-epiglottidean, really ligamentous,
Glosso-epiglottidean, a fold of mucous membrane,
Two aryteno-epiglottidean, also of mucous membrane.

The muscles connected with the larynx, and

concerned in its motions, are, anteriorly, the *sterno-hyoid, sterno-thyroid, thyro-hyoid,* and *crico-thyroid;* posteriorly, the *crico-arytenoidei postici, arytenoideus transversus,* and *obliquus;* and laterally, muscular fibres, which have been divided into the *thyro-epiglottidei, crico-arytenoidei laterale,* and *thyro-arytenoidei.*

The arteries of the larynx are, the superior laryngeal, from the external carotid; and inferior laryngeal, from the subclavian.

The mucous membrane of this organ is studded with numerous follicles, some of which have obtained the name of glands; some of these aggregated just above the epiglottis, between it and the tongue, embedded in some fat, form the *epiglottidean gland,* from which small tubes pass through the epiglottis, and lubricate its under surface.

The nerves are chiefly from the pneumogastric.

The *trachea* extends from the cricoid cartilage to the bronchi, from about the fourth cervical vertebra to opposite the third dorsal. It is covered anteriorly by the sterno-hyoid and sterno-thyroid muscles, and thyroid gland; posteriorly it is in contact with the œsophagus; laterally it is bounded by the large vessels of the neck, the nervus vagus, and sympathetic nerve, and in the chest is crossed by the left vena innominata, the arteria innominata, and the arch of the aorta.

Its figure is that of a cylindrical tube, rather flattened posteriorly, and diminishing in capacity as it descends.

It is composed of from fifteen to twenty segments of cartilaginous rings, incomplete posteriorly, the space being filled up by a musculo-membranous substance: in the expanded state of the

trachea the cartilages form two thirds of a circle; when it is contracted or collapsed about three fourths. They are thickest in front, and differ from each other in depth and size: they are largest superiorly, thinner and nearer inferiorly; they are united together by perpendicular ligamentous fibres.

The substance which completes the rings posteriorly is truly muscular. The fibres are connected transversely with the edges or ends of the cartilaginous rings; longitudinally, they descend from the cricoid cartilage to the bronchi. The lining mucous membrane of the trachea is continuous from the upper part of the larynx to the minutest ramifications of the bronchi. It is always moist, soft, and elastic; is thinner than in the larynx, and gradually more so as it passes into the ramifications of the bronchi.

The *bronchi* are formed by the bifurcation of the trachea, opposite the third dorsal vertebra.

The right bronchus is larger than the left, and is shorter, reaching the lung on a line with the fourth dorsal vertebra. It passes under the arch of the vena azygos, behind the vena cava superior, in a less oblique direction than the left bronchus.

The left bronchus passes under the arch of the aorta, accompanied by the left pulmonary artery and corresponding veins.

The structure of the bronchi is similar to that of the trachea. They divide and subdivide into numerous ramifications, till they appear to pass into a fine ligamentous tissue.

The *thyroid gland*, or more properly *body*, is situated on the front of the neck, beneath the sterno-hyoid, sterno-thyroid, and omo-hyoid mus-

cles, cervical fascia and integuments. It consists of two lateral lobes, connected in the middle by a portion of less depth, named the isthmus, which lies upon the third ring of the trachea; each lateral portion extends upwards to the side of the thyroid cartilage, and downwards as far as the fifth or sixth ring of the trachea. It is convex anteriorly, concave posteriorly; of a dusky-red colour; composed of a number of cells, containing generally a viscid fluid; and is very copiously supplied with blood-vessels from the superior and inferior thyroid arteries on each side; and sometimes an azygos branch in the centre, given off from the arch of the aorta. It has no excretory tube.

THORACIC VISCERA.

The *thorax* is a conical cavity, bounded superiorly by the first rib, the clavicle and soft parts entering and passing out of the chest; inferiorly by the diaphragm; anteriorly by the sternum and cartilages of the ribs; laterally by the bodies of the ribs and intercostal muscles; and posteriorly by the spine and the angles of the ribs.

The parts which pass through the upper aperture, are the trachea, thyroid veins, right and left carotid and subclavian arteries, internal jugular and subclavian veins, the sterno-hyoid and sterno-thyroid muscles, nervus vagus, and recurrent nerves of each side, the œsophagus, the sympathetic nerves, and longus colli of each side, and the thoracic duct, besides many other small parts of minor importance.

The contents of the thorax are the *lungs* and *pleuræ*, the *heart* and *pericardium*, and the contents of the *anterior* and *posterior mediastinum*.

The *pleura* of each side is a smooth serous membrane, forming a shut sac: one portion, lining the inside of the ribs, and the thickest, is called *pleura costalis;* the part reflected over the lungs is named *pleura pulmonalis*. It is also reflected upon the pericardium and diaphragm, on each side. By some anatomists a distinct fibrous membrane is described as existing between the ribs and the pleura.

This membrane is lubricated by a soft fluid; and the two portions are, during health, in constant apposition.

These oval bags, by meeting near the centre of the chest, form two triangular interstices, named the *anterior* and *posterior mediastinum*. Some anatomists add to these a third mediastinum, including within it the heart, pericardium, and phrenic nerves.

The *anterior mediastinum*, separated superiorly from the posterior by the bifurcation of the trachea, the arch of the aorta and vena innominata, contains the remains of the thymus gland, the origin of the sterno-hyoid and sterno-thyroid muscles, lymphatics from the surface of the liver, the internal mammary arteries and veins, and triangulares sterni muscles. Its base is formed by the sternum, its sides by the pleura of each side, and its apex by their meeting.

The *thymus* gland, scarcely perceptible in the adult, is of a considerable size in the fœtus and young child; it is first observed about the fourth month of fœtal life, increasing till birth; after

which it remains stationary, or increases slightly till about the end of the first year, when it begins gradually to decrease. It consists of two elongated lobes, placed side by side in the anterior mediastinum. The structure of this body is like that of the thyroid; within it a cellular structure is observed, with sometimes a quantity of thick fluid. It is very vascular, but the use of it is unknown.

The *posterior mediastinum* extends from the third to the tenth or eleventh dorsal vertebra. It contains the *œsophagus, aorta descendens*, the *thoracic duct*, the *par vagum* of each side, the *vena azygos*, some lymphatic glands and vessels, and the *splanchnic nerves*. The *œsophagus*, inclined to the left side of the spine, is most anterior, and is accompanied by the par vagum; the right par vagum is rather behind, but the left is in front; beneath or behind it is the aorta, a little on the left side of the spine. On the right is the vena azygos, and between these the thoracic duct.

The *lungs* are conical bodies, occupying the sides of the chest on each side of the mediastina. They are firmly attached to the heart by means of their large vessels, and to the trachea by the bronchi. The reflexion of the pleura, from the diaphragm to the lungs on either side, is named by some pulmonary ligament.

They are invested by the pleura pulmonalis, which is more delicate than the membrane lining the ribs. The two layers of pleura are in close contact, having between them only a very minute portion of fluid to lubricate them in a healthy state, but no particle of air. If by accident or

design an aperture is made into the bag of the pleura, the lung collapses from the atmospheric pressure, and the breathing becomes difficult and painful.

The colour of the lungs varies with the age. In the infant it is red; about twenty, it is bluish; and in more advanced age bluish grey, with dark spots dispersed upon them.

The shape of the lungs is conical; the apex projects a little above the first rib; they are flattened anteriorly, convex posteriorly: the surface in contact with the pericardium is concave, particularly of the left lung; they are longest posteriorly, in the perpendicular direction.

The lungs posteriorly present an obtuse margin, anteriorly a thin margin, which is short and irregular. The anterior and inferior margin of each lung is very acute. There is a deep arched opening in the lower margin of the left lung for the apex of the heart.

The right lung is largest, and generally extends highest in the neck. It is divided into three lobes, but is shortest, in consequence of the situation of the liver.

The lungs have a spongy feel, and crepitate with the pressure of the finger; they are composed of the bronchi, with their ramifications, terminating in air-cells, and lined by a mucous membrane; the pulmonary and bronchial arteries and veins, nerves, absorbents, and glands, connected together by cellular tissue, and invested by their general covering, the pleura.

On examining the minute structure of the lungs, we find them to be composed of a number of lobules connected together by interlobular cel-

lular tissue. This cellular tissue is extremely delicate, often infiltrated with serum or air, as in emphysema; and gives passage to the minute lymphatic vessels.

The lobules do not communicate with each other. They are attached to the ramifications of the bronchi and vessels, like grapes to their stalk; and each lobule may be considered as a separate lung. They are not all distended with air, in ordinary inspiration, nor by the most powerful efforts that can be made. Those of the upper part of the lungs seem to be most filled, and are most constantly in action.

Each lobule is composed of a collection of air-cells, or vesicles, which communicate freely together; these cells vary in size, and always contain some air in the healthy state. The partition between them is imperfect, and is composed of very delicate cellular tissue. These cells consist of a thin fibrous tissue, lined with mucous membrane, and upon their walls the minute capillary branches of the pulmonary arteries and veins ramify.

The average quantity of the air which the lungs contain is not quite agreed upon: perhaps 200 cubic inches may be taken as the mean. This proportion will vary with the state of inspiration and expiration, as in each of those actions a change of about 40 cubic inches is supposed to take place. The carbonic acid evolved from the lungs in 24 hours, has been estimated as much as 24,000 cubic inches, sufficient to afford 11 or 12 inches of solid carbon.

The *pulmonary arteries*, unlike other arteries, carry venous blood for the purposes of the system

generally. Their coats are thinner than those of other arteries.

The *bronchial* arteries derived from the aorta are designed for the nutrition of the lungs.

The *pulmonary veins* carry arterial or decarbonized blood, and are firmer in their coats than veins in general. They are four in number, and terminate in the left auricle of the heart.

The lungs are supplied with nerves from the pulmonary plexuses, formed chiefly by the par vagum, together with filaments from the sympathetic.

The *absorbents* of the lungs are deep seated and superficial. They pass to the bronchial glands at the roots of the lungs, and then proceed partly to the thoracic duct on the left side, and partly to a corresponding vessel on the right.

The *pericardium*, or investment of the heart, is formed by two membranes: the external one is fibrous; the inner one is serous, lining the fibrous coat, and reflected over the heart itself. It has also a partial covering from the pleura of each side, and is strengthened below by its attachment to the cordiform tendon of the diaphragm.

The fibrous bag of the pericardium is firmly attached to the central tendon of the diaphragm, inferiorly; laterally, with the pleura; and superiorly it is reflected upon the large vessels for some distance, and finally becomes continuous with their outer coat. It consists of fibres running in various directions, and is said to have eight openings in it, for the transmission of the large vessels; viz., one for the superior vena cava, two for the right and left branches of the pulmonary artery, one for the aorta, and four for the pulmonary

veins. The vena cava inferior is immediately connected with the substance of the heart after its passage through the diaphragm, and it is said not to be surrounded by this fibrous coat.

The lining serous coat is a shut sac, containing a small quantity of thin fluid, for the purpose of lubricating it, and allowing the free motion of the heart in the pericardium.

The *heart* is a hollow muscle, of rather a pyramidal figure, placed obliquely in the lower and front part of the thorax, and most inclined to the left side. It is convex above, rather flattened below, where it rests upon the diaphragm.

It is commonly described as externally divided into an apex, body, and base, a superior and inferior surface, and a right and left margin. The apex points between the cartilages of the fifth and sixth ribs. The base corresponds with the fourth and fifth dorsal vertebræ. The right margin is longest but thinnest.

The heart physiologically may be considered as double: the right side, called pulmonary, to transmit the blood only to the lungs; the other, systemic, from forcing the blood into all parts of the system. The right cavity of the heart is most capacious; the parietes of the left are by far the thickest.

The substance of the heart is formed of its muscular portion, its investing and lining membrane, and its proper vessels and nerves.

The cavities of the heart are four: two at the base, called auricles; and two at the apex, named ventricles.

When the pericardium is opened and the heart is in situ, the right side of the heart principally is

brought into view: the parts seen are, the right auricle and ventricle, the termination of the venæ cavæ, the appendix of the left auricle, the part of the left ventricle forming the apex of the heart, the root of the pulmonary artery and aorta, and the proper vessels of the heart, ramifying on its surface.

The *right auricle* of the heart may be divided into the large smooth portion, named *sinus venosus*, and the *auricula propria*.

The openings into the sinus are, one from the superior vena cava, one from the inferior vena cava, one from the coronary vein, and one into the right ventricle; and, according to some anatomists, little venous openings, termed *foramina Thebesii*. In the septum between this and the left auricle there is a depression named fossa ovalis, corresponding with the situation of the foramen ovale, surrounded by the *annulus fossæ ovalis*. There is frequently a slight orifice in the substance filling up the fossa.

A projection may be observed between the openings of the venæ cavæ, named *tuberculum Loweri*. From the upper margin of the inferior cava, a fold extends towards the annulus fossæ ovalis, named the *Eustachian valve*, less evident in the adult, but in the fœtus is supposed to direct the blood from the inferior cava into the left auricle; between this and the auriculo-ventricular opening, is the orifice of the coronary vein, with a valve partly covering it.

The *auricula propria* or *appendix auriculæ* communicates with the sinus venosus by a circular opening. It contains fleshy pillars, named *musculi pectinati*, which also extend in a thinner form

over the anterior and upper surface of the sinus venosus. Some have supposed that the use of these fibres is to commingle the blood of the two cavæ, which is of a very different quality; that of the upper vessel, containing the fluid poured into the circulation by the thoracic duct.

The right ventricle has two openings into it, the *auriculo-ventricular*, and an opening into the pulmonary artery.

It is of a triangular shape, the base being towards the right auricle, the apex near, but a little above the real apex of the heart; it is separated from the left ventricle by a thick partition, named septum cordis. The auriculo-ventricular opening is guarded by a fold of the lining membrane, named tricuspid valve, from presenting three triangular portions; of these one is anterior; another posterior; the third, towards the left side, separating this opening from that of the pulmonary artery; this, the largest portion, has been named the septum of Lieutaud: at the attached base of this valve a ring of a tendinous nature is observed underneath the lining membrane; this is named the *zona tendinea*, and enters partly into the structure of the tricuspid valve, giving strength to it. A similar tendinous zone exists at the left auriculo-ventricular opening. These tendinous zones are the most fixed points of attachment for the muscular fibres of the heart. To the edges of the valve little tendinous strings, are attached, named *chordæ tendineæ*, which, at their other extremity, are connected with projecting muscular bundles, named *carneæ columnæ*. At the upper and anterior part, and to the extreme left, is the opening of the pulmonary artery,

towards which the walls become smooth. This part is named *pars plana*, and, from an appearance of contracting towards the opening, is called infundibulum.

The carneæ columnæ may be divided into three sets, one attached to the entire length of the wall of the ventricle, another attached at each end, with the centre free, the third attached at one end to the wall of the cavity, the other connected with the chordæ tendineæ.

The opening of the pulmonary artery is guarded by three *semilunar* or *sigmoid* folds, or valves, each of which, in the centre of its free margin, has a little granular body, called *corpus sesamoideum*, or *corpusculum Arantii*.

The pulmonary artery, passing upwards and backwards, nearly $2\frac{1}{2}$ inches within the pericardium, divides into right and left branches. The right, which is the largest, passes under the arch of the aorta, and separates into three branches, which enter and ramify in the lungs. The left branch crosses over the descending aorta, and divides into two branches, which, like the right, divide and subdivide, terminating in capillary vessels, which reflected form the commencement of the four pulmonary veins.

The left auricle, situated at the upper and back part, like the right one, has a smooth portion, named *sinus arteriosus*, and an auricular appendix containing musculi pectinati, but not so large as in the right side. There are five openings into it, four from the pulmonary veins, entering at its angles, and one into the left ventricle, rather smaller than on the right side. The fossa ovalis,

with its annulus, may be perceived, but is not so evident as in the right auricle.

The left ventricle, of a conical form, has parietes much thicker than the right, and is longer, but its capacity for blood is rather smaller. Its extremity forms the apex of the heart; its inner wall forms the greater portion of the *septum ventriculorum*. It has an opening from the auricle, and one into the aorta. The auricular opening is surrounded or guarded by the *mitral valve*, which is strengthened by the *chordæ tendineæ*, and these are attached by their other extremity to the *carneæ columnæ*.

The mitral valve consists of two pieces, of which the right one is much the larger, and is placed between the opening from the auricle and that into the aorta, and is more deserving the name of septum than a similar portion of the tricuspid valve: its use is to divide the two currents. At the upper part of the ventricle, and anterior to the auricular orifice, is the opening into the aorta.

The aorta and pulmonary artery are connected to the heart in a similar manner. The external and internal coats are continuous with those of the heart, but the middle elastic coat has a peculiar arrangement. It is found to commence by a defined edge, presenting three festoons, by which a few tendinous fibres connect it with the substance of the heart. At these openings, tendinous zones are described as existing, like those at the auriculo-ventricular openings, but are much weaker and less visible. At the commencement of the aorta there are three *sigmoid* or *semilunar* valves, with the corpora sesamoidea, as in the pulmonary artery.

The structure of the muscular substance of the heart is very peculiar, and that of the ventricles is most deserving of attention. The ventricles appear to consist of two muscular bags, contained within a third, common to both.

All the muscular fibres take their origin from the tendinous zones, which may be observed between the junction of the auricles and ventricles, and also terminate in them. They are arranged in successive layers, but the fibres of them are in some measure blended with each other, so that it is impossible to assign to them any definite number.

The superficial fibres common to both ventricles, are oblique and curvilinear, proceeding from the base towards the apex; those on the anterior surface pass from right to left, those on the posterior inferior surface in an opposite direction. These fibres do not terminate at the apex, but are matted together, and reflected back towards the base again. Some of the superficial fibres at the apex of the heart are curved and turned inwards, forming reflected fibres, which constitute the fleshy pillars of the heart.

The proper fibres of each ventricle are placed between the superficial and deep fibres of the common muscular coat, in the form of a cone, and resting against each other, with a superior large opening, viz. auricular, and an inferior small one, which gives passage to the deep fibres. They proceed from the tendinous zone, in a spiral manner from the base to the apex and back again. The common reflected deep fibres pass in, as just mentioned, and diverge in a radiating manner, and are distributed in three modes: some pass to the

opposite wall of the interior of the ventricle, others run along the inside of the same wall, and a third set forms the carneæ columnæ. The muscular fibres of the auricles are also of two kinds, proper and common: the latter run in a transverse direction; the proper fibres are thin, and take their origin from the aurico-ventricular zone, and also return to it. Some of them run obliquely, others perpendicularly, and are more developed on the left than right auricle.

The *aorta* takes a course upwards, forwards, and to the right; then passes backwards, downwards, and to the left, descending on the left side of the spine to its bifurcation, opposite the fourth lumbar vertebra. It is first called the *arch*, which consists of the three parts, the ascending, transverse, and descending; then becomes descending thoracic, and afterwards abdominal aorta.

The first arteries given off from the aorta are the right and left *coronary*, for the supply of the heart itself. These vessels are sent off before the pericardium quits the aorta, and receive their blood in a different manner from all other arteries in the body. The blood enters them by regurgitation, and not from the propelling force of the heart, for when the ventricle contracts and forces the blood into the aorta, the sigmoid valves are pressed laterally against the orifices of the coronary arteries, and thus the blood is prevented entering them.

The *right coronary* artery passes along the right border of the pulmonary artery, then transversely in the groove between the right auricle and right ventricle, to the under surface of the heart, as far as the septum, where it divides into

two branches; one runs in the groove between the left auricle and ventricle, anastomosing with the left coronary, the other descends between the two ventricles as far as the apex of the heart.

The *left coronary* artery, smaller than the right, comes off from the aorta, a little higher up, and is first observed between the pulmonary artery and left auricle; when it arrives at the septum ventriculorum, it divides into two branches, one takes a transverse course to the left, running in the groove between the left auricle and ventricle, anastomosing with right coronary; the other runs down on the upper surface of the heart, along the septum of the ventricles as far as the apex. From these vessels minute branches pass into the several parts of the heart, and supply the roots of the large vessels.

The arteries from the arch are:

The *arteria innominata*, which divides into right carotid and right subclavian.
The *left carotid*.
The *left subclavian*.

The common carotid divides into external and internal.

The branches from the external carotid are:

Anteriorly,	Superior thyroid.
	Lingual.
	Labial.
Posteriorly,	Muscular.
	Occipital.
	Posterior aural.
Ascending,	Pharyngeal.
Terminating,	Temporal.
	Internal maxillary.
	Transverse facial.

The branches of the internal carotid within the cranium are:

Ophthalmic.
Anterior cerebral.
Middle cerebral.
Posterior communicating.

The branches of the subclavian are:

Vertebral.
Internal mammary.
Inferior thyroid.
Cervicalis ascendens.
Suprascapularis.
Posterior scapular.
Cervicalis profunda.
Intercostalis superior.

The descending thoracic aorta gives off:

Bronchial arteries, to nourish the lungs.
Œsophageal.
Intercostal, to the pleura, intercostal muscles, and spine.

The abdominal aorta gives off the following arteries:

The *right* and *left phrenic,* to the diaphragm.

The *cæliac,* which divides into the *hepatic,* to the liver, gall-bladder, and stomach; the *splenic,* to the spleen, pancreas, and stomach; the *coronaria ventriculi,* distributed to the stomach, œsophagus, omentum minus, and diaphragm.

The *superior mesenteric* supplies the small intestines, and gives to the large intestines, the *ilio-colica, colica-dextra,* and *colica-media.*

Two *Capsular,* to the renal capsules.

Two *Renal,* to the kidneys.

Two *Spermatic,* to the testicles.

Inferior mesenteric, to the large intestines.

Lumbar, four on each side, to the loins.

Middle sacral, to the os sacrum, peritoneum, &c.

And terminates in *common iliacs,* to supply the pelvis and lower extremities.

The *hepatic* gives off, before it divides, the *pylorica superior* and *gastrica-duodenalis,* which

gives off the *pylorica inferior, pancreatica duodenalis,* and *gastrica-epiploica dextra.* The hepatic then divides into right and left branches ; the right one gives off the *cystic branch.*

The branches of the internal iliac are, in the female :

Sacra lateralis.
Iliolumbalis.
Uterine.
Middle Hæmorrhoidal.
Vesical.
Vaginal.
Hypogastric.
Gluteal.
Ischiatic.
Obturator.
Pudic.

For a minute description of the arteries, vide Dr. Steggall's Manual for the College.

The *coats* of an artery are *three:* an external or cellular coat, a middle fibrous or muscular coat, which is thick, yellow, and elastic. By means of this coat the arteries remain patulous after death. The third, or inner coat, is thin and transparent, resembling a serous membrane. It is a continuation of the lining membrane of the heart.

The coats of the veins are the same in number, but much thinner. Some anatomists, however, state that veins have only two coats, the external one fibrous, and the lining coat, which has rather less of a serous appearance than the lining coat of arteries.

The coats of the arteries receive their vessels (vasa vasorum) from the neighbouring arteries, and are abundantly supplied with nerves from the cerebral, spinal, and sympathetic nerves.

The veins in general accompany the arteries, and receive their names accordingly ; the principal exception is the vena azygos.

The *vena azygos* commences by two or three lumbar veins, then passes through the diaphragm, ascends in the chest on the right side of the spine, receiving the right intercostal, bronchial, and œsophageal, and the five or six lower left intercostal veins; after receiving these vessels it winds round the right bronchus, and ends in the superior vena cava, just before it enters the pericardium.

The superior intercostal veins, with the left bronchial and œsophageal, form the superior intercostal vein, which terminates in the left vena innominata, or crosses over the spine to unite with the vena azygos.

The five or six lower left intercostal veins sometimes unite into one vessel, which is named by some anatomists azygos minor. It generally crosses the spine to pass into the vena azygos.

The *thoracic duct* commences at the third lumbar vertebra, by an enlarged extremity, termed receptaculum chyli; it passes up through the aortic opening of the diaphragm, between the aorta and vena azygos ; rather above these it quits the mesial line, and runs up behind the aorta, ascends in the neck as high as the fifth or sixth cervical vertebra, curves downwards, and terminates in the angle formed by the left subclavian and internal jugular veins.

ABDOMEN.

The *abdomen*, the largest cavity in the body, extends from the diaphragm to the pelvis, which

form its superior and inferior boundaries. It is bounded anteriorly and laterally by the abdominal muscles and parietes, and posteriorly by the spine, the quadratus lumborum, and psoæ muscles.

The coverings of the abdomen are, the cuticle, rete mucosum, cutis vera, adipose tissue, cellular tissue, (here named fascia superficialis,) the muscles with their tendinous expansions, fascia transversalis, and the peritoneum.

Anatomists divide the abdomen, externally, by transverse or circular lines, into three regions: first, a line is drawn round the body, on a level with the cartilage of the ninth rib, and forms the lower boundary of the epigastric region; another line is drawn across on a level with the crista of each ilium, forming a limit between the umbilical and hypogastric regions; a perpendicular line may then be made on each side, from the edge of the eighth rib, to intersect the centre of Poupart's ligament. By this arrangement, the superior zone, or epigastric region, is subdivided into the right and left hypocondrium and proper epigastrium, or scrobiculus cordis. The central zone is separated into the right and left lumbar and proper umbilical region, and the lower portion is partitioned into the right and left iliac, and hypogastric or pubic regions.

The abdomen contains the alimentary canal and its appendages, and part of the urinary and genital organs.

The alimentary canal in the abdomen comprises the *stomach*, the *small* and *large intestines*.

The appendages are the *liver*, with the *gall-bladder*, the *spleen*, and *pancreas*.

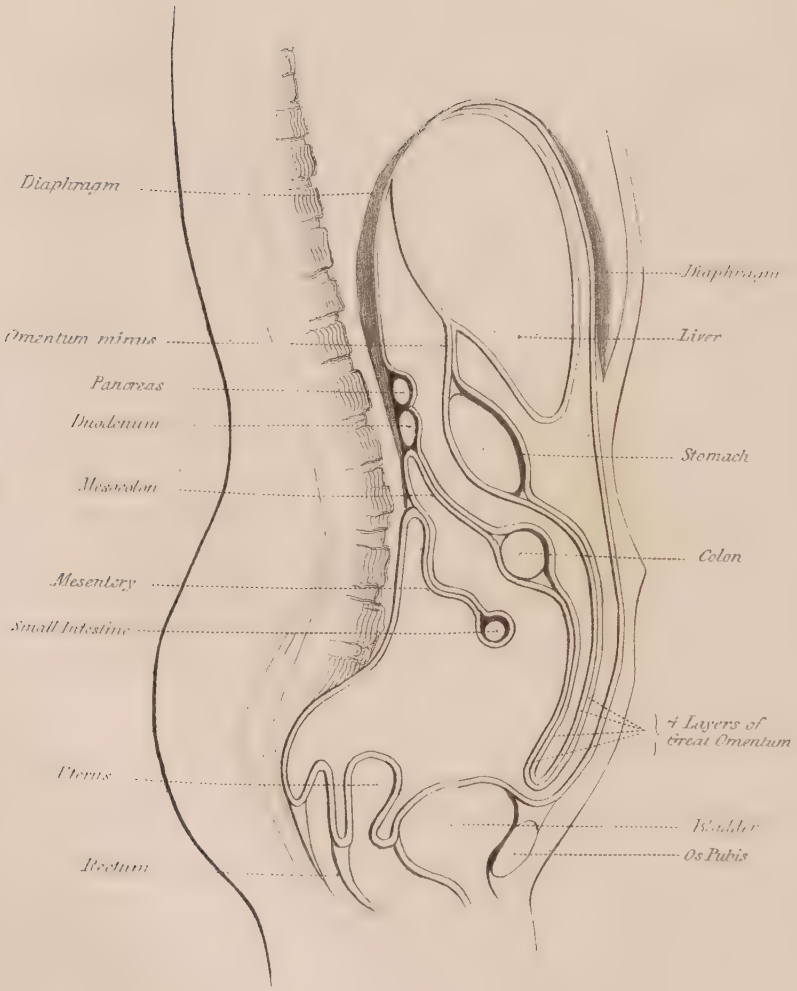
The urinary organs are the *kidneys*, the *ureters*, and part of the *bladder*, when distended.

The genital organs in the abdomen are restricted to the female, and only strictly so in the impregnated state. They are the *uterus*, *Fallopian tubes*, and *ovaries*.

When the abdomen is opened in the usual manner, the parts brought into view are the following: a small portion of the anterior and inferior part of the liver, the fundus of the gall-bladder, a portion of the stomach, and the great omentum, laterally, portions of the colon. If the omentum be raised, the small intestines and transverse colon may be seen, and part of the bladder if it be distended.

The *peritoneum* is an elastic serous membrane, lining the cavity of the abdomen, and investing the various viscera, giving them strength and support. Its reflexions from one viscus to another form duplicatures, which receive different names, according to their situation. The reflexion of the peritoneum, from the diaphragm to the liver, forms the ligaments of the liver; that from the liver to the stomach forms the lesser omentum; from the stomach to the transverse colon forms the great omentum; the portion enclosing the colon forms the mesocolon; that which extends down and over the small intestines is called the mesentery. There are, besides these, the ligaments of the bladder, uterus, and rectum, and also the appendices epiploicæ, which are formed by it. In the male the peritoneum is a perfectly shut sac; but in the female there is an opening into it on each side, from the Fallopian tube, the only instance in the body in which a mucous and serous membrane communicate. It must be

A Diagram explanatory of the Reflexions of the Peritonæum.



borne in mind that all the viscera are external to the peritoneum.

Reflexions of the Peritoneum.—Tracing the peritoneum upwards from the abdominal muscles, it lines the under surface of the diaphragm, passes on to the liver, (forming its ligaments,) and at its concave part meets a layer coming from the pillars of the diaphragm and under surface of the stomach. The two layers pass forwards to the small curvature of the stomach, forming the lesser omentum, cover the stomach, meet at the great curvature, and hang down in folds over the intestines; they then ascend and embrace the colon, meet again, forming the mesocolon, and again separate. The lower layer passes down, is reflected from the spine to the small intestines, surrounds them, and returns to the spine, forming the mesentery, then descends laterally over the kidneys, part of the rectum, mounts up towards the bladder and uterus, and ascends upon the abdominal parietes. The upper layer of the mesocolon goes over the pancreas, duodenum, and crura of the diaphragm, and rises to meet the other portion at the under surface of the liver.

This portion of the peritoneum lines a space, called the bag of the omentum, which has not a very free communication with the rest of the abdominal cavity. The only opening into it is behind the rounded edge of the lesser omentum, which contains the large hepatic vessels, and is by some called Glisson's capsule. The passage is named the *Foramen of Winslow*; and its boundaries are as follows:

Anteriorly,	the lesser omentum and hepatic vessels.
Posteriorly,	the ascending layer of the transverse mesocolon.
Superiorly,	lobulus caudatus of the liver.
Inferiorly,	the superior portion of the duodenum.

The *stomach* is a musculo-membranous bag, interposed between the œsophagus and duodenum. It is situated in the left hypochondrium, under the left false ribs, extends across the epigastric region, and slightly into the right hypochondrium.

The parts in relation with it are,

Above and in front, the liver, diaphragm, and ribs.
Inferiorly, the colon and mesocolon.
Posteriorly, the pancreas, spleen, and left supra-venal capsule.
At its right extremity, the duodenum, liver, and gall-bladder.

There are two openings into it, the *cardiac* or *œsophageal*, and *pyloric*. The former is most posterior and superior, so that the stomach inclines obliquely forwards and downwards.

There are two surfaces, an anterior and posterior, in the ordinary state; but when the stomach is distended, the anterior becomes superior, and the posterior, inferior; the lesser arch is carried further backwards, and the greater more forwards, extending even into the umbilical region. In this state of the stomach, its right extremity is in close contact with the gall-bladder.

The stomach in its figure resembles a curved or oblong cone; it is largest at its œsophageal end; the left third beyond the œsophagus is called the cul-de-sac of the stomach; which in the child scarcely exists, and which affords an explanation why they vomit with so much facility.

The pyloric orifice is even smaller than the commencement of the duodenum. It is so situate as in a great measure to form an acute angle with the œsophagus.

The stomach is kept in its situation by its union with the œsophagus and duodenum, by the lesser

and greater omentum, by the splenic omentum, and by the peritoneum attaching it to the diaphragm.

The stomach is formed by four coats, a *peritoneal*, *muscular*, *nervous*, and *villous*, connected together by cellular tissue.

The *peritoneal coat* is external; it is a continuation of the small and great omentum, smooth and shining, attached by its inner rough surface to the muscular coat. It does not cover the stomach along either curvature.

The *muscular coat* consists of three series of fibres, longitudinal, circular, and oblique.

The *longitudinal* or *external fibres* are continued from the œsophagus; they spread out upon the surface of the stomach, and, on reaching the pylorus, are collected into bundles, somewhat as in the large intestines. The external fibres are softer and more diffused than the internal ones, and are more evident along the curvatures.

The *oblique* or *transverse fibres* form the deepest layer; they surround the stomach obliquely, often crossing each other, and are most abundant about the cul-de-sac.

The *circular fibres*, continued from the œsophagus, are most evident at the right end of the stomach: in the centre they are often strong, and give an hour-glass appearance to the stomach. At the pylorus, they are much developed, and form, as it were, a sphincter to it.

The *nervous* or *fibrous coat*, rarely described by anatomists at present, is situated between the muscular and mucous coats; it is distinguished by its white colour and its loose texture, and affords a medium for the distribution of the vessels

which are to supply the other coats. It is continuous with a corresponding membrane in the œsophagus.

The *lining* or *mucous coat* is corrugated, soft, and of a reddish colour. It is always moist, and lubricated by a tolerably thick mucus. The *rugæ* run in different directions: those near the œsophagus have a stellated appearance; others, and the most constant, run longitudinally from the great end to the pylorus, connected by lateral prominences. These almost disappear when the stomach is much distended. A distinct loose fold of it assists in the formation of the pylorus.

This membrane, minutely inspected, presents an immense number of small prominences, which give the villous appearance. They appear to be composed of a delicate network of vessels, with perhaps orifices of absorbent vessels.

The stomach is studded with mucous follicles, situated between the rugæ, and these have been named *glandulæ Brunneri*, most numerous at the œsophageal end, and along the curvatures.

The arterial branches for the supply of the stomach are all from the cæliac axis. They are the *coronaria ventriculi* or *superior gastric*, distributed to the smaller curvature; the *superior* and *inferior pyloric*, to its pyloric end; and the *vasa brevia*, *gastrico-epiploica sinistra* and *dextra*, to the larger curvature.

Its nerves are chiefly from the par vagum, with some filaments from the sympathetic and phrenic.

Its veins pass chiefly into the splenic vein, and its absorbents into the thoracic duct.

The intestines are divided into small and large.

The length of the human intestinal canal is about six times greater than that of the trunk; and is still longer in proportion in graminivorous animals.

The small intestines are the *duodenum*, *jejunum*, and *ilium*. In length they form about two thirds of the intestinal canal.

The small intestines, as also the large, have the same coats as the stomach, but with some exceptions, in relation to the peritoneum. These coats are generally stated to be three. The muscular coat consists of two series of fibres, longitudinal outside, circular inside. The mucous or villous coat, which is much the largest in the small intestines, is arranged in folds, named valvulæ conniventes, to afford a larger surface for absorption, and to cause some retardation in the passage of the chyle. This coat is studded with mucous follicles; those of the duodenum are named glandulæ Brunneri; those in the jejunum and ilium, glandulæ aggregatæ or Peyeri.

The first portion, the *duodenum*, so named from its length being equal to the breadth of twelve fingers, *i. e.* from eight to nine inches, commences at the pyloric end of the stomach.

It is rather larger than the other small intestines, and from a supposed marvellous distensibility, has been named *ventriculus succenturiatus*.

It is also imagined that it is less covered by peritoneum, in order that this distension may be more easily accomplished.

The duodenum first inclines upwards, backwards, and to the right, and having arrived near the neck of the gall-bladder, it bends vertically downwards, and again changes to a transverse direction, thus forming two curves or angles.

Hence it is convex to the right, concave internally and to the left; and is divided into three portions.

The *first* portion of the duodenum is in immediate relation with the liver and neck of the gall-bladder, posteriorly with the hepatic vessels and small omentum, and is almost entirely surrounded by peritoneum. Its length is about two inches.

The *second* portion, perpendicular, has

In front and externally, the ascending colon.
Behind, the concave portion of the right kidney.
Internally, the pancreas.

This part is from two to three inches long; at about the middle of its posterior surface is the opening from the ductus choledochus and pancreatic duct; it is only covered anteriorly by peritoneum.

The *third* portion, transverse, is covered, anteriorly, by the mesocolon.

Bounded above, by the pancreas.
Anteriorly, by the stomach.
And posteriorly, by the vena cava, aorta, and crura of the diaphragm.

The regions occupied by the duodenum, are the right hypochondrium, the right lumbar slightly, and finally, the junction of the proper epigastric and umbilical regions.

It is distinguished from the jejunum and ilium by being shorter, more partially covered by peritoneum, confined to its position, and by having more openings into it.

The *ductus communis choledochus*, after pass ing some way between the muscular and mucous coats, opens into the duodenum, near the junction

of the second and third portions, and sometimes by a common orifice with the pancreatic duct. It occasionally enters as high up as the superior curve or angle, at a distance of two or three inches from the pylorus. The arteries of the duodenum are from the hepatic and superior mesenteric. In this intestine, chylification takes place.

The rest of the small intestines consist of the jejunum and ilium.

The upper two fifths of this portion of the intestines, is called *jejunum*, and the lower three fifths *ilium*.

The *jejunum*, so named from being generally found empty, terminates in the ilium, and closely resembles it in its structure.

The distinctive characters of the *jejunum* from the ilium are, its coats are thicker, it is of a redder colour, has more valvulæ conniventes, and consequently a greater surface for absorption.

The jejunum and ilium occupy, in part, the umbilical region, parts of the lumbar, iliac, and hypogastric regions, and in some measure rest in the pelvis of the adult. They are covered anteriorly by the great omentum, and surrounded by the arch of the colon.

In the lower part of the ilium there is a large number of mucous glands or follicles, named Peyer's glands, collected into clusters, hence named glandulæ aggregatæ; they occupy the convex surface of the intestine, most distant from the mesentery. In typhus fever and phthisis they are often found inflamed and ulcerated.

The jejunum and ilium are supplied with blood by the superior mesenteric artery.

The large intestines commence at the termina-

tion of the ilium in the right iliac fossa; they are the *cæcum*, *colon*, and *rectum*. They have the same coats as the small intestines. Their length is from three feet and a half to four feet, forming about a fifth of the intestinal tube.

The large intestines are particularly characterized by their sacculated appearance, occasioned by ligamentous bands, and differ from the small intestines in being wider, shorter, and straighter, and by having the appendices epiploicæ attached to them.

The *cæcum*, or *caput coli*, is the first portion; it commences from the ilium, and is situated beneath the right kidney, resting in the right iliac fossa.

It is bounded in front by the abdominal parietes; behind, by the iliacus muscle; internally, has the ilium opening into it. It is generally covered by peritoneum on its anterior surface only, but sometimes is surrounded by it, like the colon; and may then be said to be attached by a meso-cæcum.

At the junction of the cæcum and colon with the ilium, the lining membrane, with muscular fibres, forms folds, called *ilio-cæcal* and *ilio-colic valves*.

These valves present each a concave border, looking upwards and towards the right. The ilio-colic portion is horizontal; the ilio-cæcal nearly perpendicular: they are united at each extremity, and if either of them be pressed against, the opening between them becomes almost perfectly closed.

There is a little worm-like appendage attached to the cæcum at its under and back part, called *appendix vermiformis*.

This varies in length from one to six inches, and

is ordinarily of the size of a goose-quill. Its precise position is very uncertain, although it more frequently projects or hangs down over the border of the pelvis. Its cavity is small, ending in a cul-de-sac, and contains a little mucus. Its structure is like that of the large intestines. The use of this body is unknown.

The colon is divided into four portions; the *ascending*, the *transverse*, the *descending*, and its *sigmoid flexure*, which terminates in the rectum, opposite the left sacro-iliac synchondrosis.

Little folds of peritoneum, containing fat, hang down from the colon, called *appendices epiploicæ*.

The ascending colon passes up on the right side, bounded

In front, by the abdominal parietes.
Behind, by the quadratus lumborum and right kidney.
Above, by the margin of the liver.

The transverse colon extends from the right to the left hypochondrium, along the junction of the epigastric, with the umbilical region; on the right side it touches the gall-bladder, on the left it is just below the spleen: it is kept in its place by the transverse mesocolon: thus, above it, we find the liver, which is sometimes slightly grooved for it, the gall-bladder, the stomach, and lower part of the spleen. Below the transverse colon there are only the small intestines.

The left lumbar, or descending colon, is bounded in a very similar manner to the right, as to the parietes and small intestines, only reversing the sides; its caliber is rather less, and at the upper part it is deeper seated.

The *sigmoid* flexure of the colon, is situated in the left iliac fossa. It is connected by a rather loose fold of peritoneum, which allows it a considerable degree of motion, and, from its curved form, is supposed to be intended for a partial reservoir of fæcal matter. It is bounded in front by the abdominal parietes; behind, by the iliacus muscle, on which it rests; internally, it is in relation with the small intestines.

The longitudinal bands, which are three on the ascending and transverse colon, often merge into two in the descending and sigmoid portions, and the sacculi are frequently less developed.

The *rectum* commences at the sigmoid flexure of the colon, and terminates in the anus.

Arising from the left side, it immediately inclines to the mesial line, follows the curve of the sacrum, and terminates at about an inch beyond and before the coccyx: from this bone it turns a little backwards, and is thus removed from the vagina of the female, and urethra of the male.

It is cylindrical in shape, and not sacculated like the colon, in consequence of being devoid of the longitudinal bands; the longitudinal fibres are dispersed over it generally; it is narrowest at its upper part, and becomes gradually dilated till it arrives near the anus, just above which the dilatation is considerable, like a large reservoir, which sometimes is enormously distended with fæces.

Boundaries and *relations*.—Behind it, first, there is the sacro-iliac symphysis, then the curvature of the sacrum and coccyx; superiorly, it is attached to the sacrum by a fold of peritoneum, named mesorectum, and is separated from the symphysis and sacrum by the pyriformis muscle, the sacral

plexus, and hypogastric vessels. In the portion beyond the coccyx, the levator and sphincter ani form a kind of floor for it.

In front, the rectum is free at its upper part, but adherent in the lower portion; and, as its relations vary with the sex, they must be spoken of separately.

In the male the upper part looks towards the posterior wall of the bladder, from which it is separated by some convolutions of the small intestines; at its adherent portion, lower down, it is in relation with the bas-fond, or lower fundus of the bladder, where the trigone is situated, and which thus rests upon the rectum. The peritoneum sometimes descends so as to cover this part, and may even extend as far as the prostate gland, forming a cul-de-sac lower than usual; further down the rectum is in close contact with the prostate gland, and still further has some relation to the urethra, but is separated from it by a triangular space, the base of which is forwards and downwards, the apex upwards and backwards.

In the female, the free portion of the rectum is in apposition with the broad ligament, Fallopian tube, and ovary of the left side, the uterus, and the vagina. Between these parts and the rectum there is a cul-de-sac of peritoneum, as in the male between the rectum and bladder; in this part, when the rectum and uterus are comparatively empty, there are some convolutions of the small intestines. In the lower part, the rectum is in immediate connexion with the vagina, to which it is very adherent; but as it descends still lower it quits the vagina as it turns backwards, and leaves a perineal triangular space, analogous to that in the

male. On its sides, the free part of the rectum has convolutions of the small intestines, but lower down a large quantity of loose cellular tissue containing a considerable quantity of fat.

The inside of the rectum presents a number of longitudinal folds, like those of the œsophagus; and these are intersected by a few semicircular ones. The longitudinal folds have been named the pillars of the rectum.

The cæcum and part of the colon are supplied with blood from the superior mesenteric artery; the rest of the colon and upper part of the rectum, from the inferior mesenteric; the rest of the rectum receives blood from the middle hæmorrhoidal and internal pudic artery. The rectum is one of the most vascular parts of the intestinal canal.

The veins of the intestines terminate in the *vena portæ*.

The nerves are supplied from the *great sympathetic* and *eighth pair*.

The rectum alone is supplied with nerves, both from the ganglionic and cerebro-spinal system. This is necessitated by the functions of this intestine, which is partly under the influence of the will, and partly independent of it.

The *liver* is a conglomerate gland, the largest of the body, from three to four pounds in weight; it is situated in the right hypochondrium, epigastrium, and part of the left hypochondrium. It is superiorly convex, and inferiorly concave. It is divided, for the sake of description, into a right and left lobe; on the under surface of the right or large lobe, some anatomists describe three divisions or lobes, with the names *lobulus Spigelii lobulus caudatus*, and *lobulus quadratus*. The

latter is the quadrangular portion, bounded by the gall-bladder to the right, the transverse fissure behind, fossa umbilicalis to the left, and acute margin of the liver in front and below. The lobulus Spigelii is behind the transverse fissure, between the vena cava inferior, and fossa ductus venosi.

The *liver* is kept in its place by five ligaments, which are named the *broad*, the *round*, the *right*, and *left lateral*, and the *coronary* ligament.

These ligaments are formed by the peritoneum, excepting the round ligament, which consists of the remains of the umbilical vein.

The liver has two coats, the peritoneal and tunica propria, of cellulo-fibrous structure, which also surrounds the different vessels, and accompanies them to their minutest ramifications, thus forming the real capsule of Glisson. There are five fissures, or depressions of the liver, viz. the *great* or *longitudinal fissure*, which may be divided into two parts; the anterior half, named *fossa umbilicalis*, giving lodgement to part of the round ligament in the adult, and to the umbilical vein in the fœtus; the posterior half, named *fossa ductûs venosi*, from its function during fœtal life: the *fissure* for the *vena portæ*, named sulcus transversus, or sinus venæ portarum, through which pass the great vessels, nerves, biliary ducts, and absorbents; that for the *vena cava*, and the depression for the *gall-bladder*.

There are also several depressions of the liver mentioned, but they are generally very indistinct: there is one for the stomach, one for the colon, and one for the right kidney, and a groove for the œsophagus.

The liver may be considered as a collection of

little livers or acini, which are composed of *ramifications of blood-vessels, absorbents, biliary ducts.* and *nerves*, connected together by cellular substance.

The minute structure of the liver has been investigated by Mr. Kiernan, one of the most skilful anatomists of the present age. The results of his observations have the following purport:

He first commences by stating that the liver has three surfaces, viz. the commonly received surface, the portal surface, and the hepatico-venous; the two latter are such as would be exposed by mechanically separating the lobules of the liver from the branches of these vessels.

The ramifications of the venæ hepaticæ resemble a tree with its branches, upon which the lobules are placed.

The lobules have somewhat an hexangular form, connected together by a delicate cellular tissue, but presenting between each other interlobular spaces, which lodge the interlobular veins.

The interlobular veins are the minute ramifications of the vena portæ, after it has received the small branches of the hepatic artery. These interlobular veins send into each lobule, from its circumference to its centre, minute branches which conjointly form the lobular venous plexuses; these minute branches terminate in biliary pores, and in reflected minute vessels in the centre of the lobule, which are named intralobular veins. These intralobular veins pass into the sublobular veins, which are the primary rootlets of the venæ cavæ hepaticæ. The hepatic artery, after entering the portal canals, divides into branches, which

are supposed to nourish the liver, and subsequently are lost to view by passing into the branches of the vena porta, and thus forming a single ramifying vessel.

The biliary tubes, commencing in each lobule, emerge at the circumference, run in the interlobular spaces, and, by uniting together in the portal canals, form, ultimately, the hepatic duct.

The tunica propria is reflected internally at the transverse fissure, giving a covering or sheath to the vena portæ, the hepatic artery, and biliary tubes; and thus forms the portal canals, which are distributed upon these vessels to their most minute ramifications.

The blood-vessels of the liver are, the *hepatic artery*, for its nourishment; the *vena portæ*, which ramifies through it to secrete the bile; and the *vena hepatica*, which returns the blood from the hepatic artery and vena portæ. The *nerves are* from the *great sympathetic* and *eighth pair*.

The vena portæ is formed by the junction of the *superior* and *inferior mesenteric veins*, with the *splenic vein*, and branches from the stomach, pancreas, and gall-bladder. It carries blood of a very dark colour, and is unlike all other vessels of the body; for it commences, like a vein, by small branches which converge to form a large trunk, behind the pancreas, and entering the liver, resembles an artery in its mode of division and ramifications, and functions.

The excretory ducts of the *liver, tubuli biliarii*, arise from the acini, and ultimately join to form the *hepatic duct*, which unites with the *cystic duct*, and forms the *ductus communis choledochus*.

The *gall-bladder* is on the concave surface of

the right lobe. It consists of a *fundus*, *body*, and *cervix*. It has three coats, a partial, external, or *peritoneal*, a middle one, fibrous, and a *villous* coat. A duct proceeds from the cervix, called *ductus cysticus*, which joins the hepatic duct, and forms the *ductus communis choledochus*. This duct is about two inches and a half in length, and terminates in the duodenum.

The lining coat of the gall-bladder has a reticulated honeycomb appearance, but does not possess any follicles for the purpose of secretion. It is useful as a reservoir of the bile, and may possibly absorb some of the thinner parts of this fluid.

The cystic duct presents internally a number of folds, which are generally circular; sometimes they run perpendicularly, or in a spiral direction. Their free edge is concave. They are not sufficient to arrest the passage of fluid either way.

Its vessels and nerves are derived from the same as those of the liver.

The *pancreas* is a long, flattened, glandular body, placed in the back part of the epigastric region, behind the stomach, and in front of the spine. Its greater extremity, named the *head*, is connected by cellular substance with the duodenum; its lesser, called the tail, with the spleen. It has the stomach and small omentum in front, and opposite the first lumbar vertebra. The parts found posterior to it are, the splenic and superior mesenteric vein, the trunk of the vena portæ, the superior mesenteric artery and accompanying nerves, the vena cava, the aorta, and pillars of the diaphragm: towards the left side it is in immediate relation with the renal vessels, the left kidney, and its capsule. Its upper margin is

grooved by the splenic artery, and is contiguous to the first portion of the duodenum, the lobulus spigelii, and cæliac axes; its lower border, thinner, rests against the duodenum and superior mesenteric artery; its head rests against the concavity of the duodenum, and touches the ductus communis choledochus; the left extremity rests against the spleen.

It resembles the salivary glands in structure, and is nearly identical in the fluid it secretes; hence it is often enumerated amongst the salivary glands. It has no distinct capsule, but a delicate cellular tissue unites the various lobules together. Each lobule emits a duct which passes directly into the large duct, running the whole length of the pancreas, from left to right. The pancreatic duct pours its fluid into the ductus choledochus, just before it opens into the duodenum; sometimes there is a second duct, which perforates the duodenum separately.

The arteries of the pancreas are branches from the hepatic, splenic, and superior mesenteric. Its veins go to the vena portæ, and its nerves are from the eighth pair and great sympathetic.

The *spleen* is a soft oblong body of a purplish colour, situated in the left hypochondrium, between the large extremity of the stomach and the false ribs; its lower part is behind the colon, and rests upon the upper end of the left kidney; it is externally convex, internally concave, and is covered by peritoneum and its tunica propria.

The internal structure of the spleen is much disputed; some contend that the splenic artery terminates in very small branches, which are coiled up like the shell of a snail, and which admit

of considerable distension: these have been named *helicine* arteries. This organ seems to be largely composed of cells, which communicate freely with the veins, as may be seen by injections, but less freely with the arteries; they seem to be an interposed structure, between the two vessels; they are elastic, and at times are liable to enormous distension, as in agues. A quantity of dark fluid is obtained from the spleen by pressure; this may be washed away by water, but does not seem to be of the nature of a secretion, for it has no excretory duct. It varies in size, at different periods of life: it is smallest in the infant, and becomes gradually larger as age advances.

Its artery, called the *splenic*, arises from the *cæliac*. Its veins assist in forming the vena portæ; it receives nerves from the sympathetic and par vagum.

The *kidneys* are two oval glandular bodies, smooth on their surface, but lobulated in the fœtus during the early months, placed behind the peritoneum on each side of the spine, resting upon the diaphragm and quadrati lumborum muscles, opposite the two last dorsal and two superior lumbar vertebræ. The right is a little the lower, in consequence of the situation of the liver. They are about four inches in length and two in breadth; they have two surfaces, an anterior one convex, a posterior one flattened; they have two extremities, of which the superior is the largest and nearest the spine; a convexity externally, and a concavity internally.

The boundaries of the right kidney are, superiorly, the renal capsule and liver; inferiorly, the cæcum, but scarcely ever descends so low; an-

teriorly, the ascending colon and duodenum; posteriorly, the diaphragm and quadratus lumborum; externally, the diaphragm and abdominal parietes; internally, the crura of the diaphragm, the psoas muscle, large vessels of the kidney, with the vena cava and spine.

The boundaries of the left kidney are, superiorly, the spleen; externally and posteriorly, as on the opposite side; anteriorly, the descending colon; and internally, its vessels, the crura of the diaphragm, psoas, aorta, and spine.

The kidneys have a *proper coat*, of a fibrous or cellular nature, and an anterior covering only of peritoneum; they are generally imbedded in a quantity of fat and loose cellular tissue.

They are composed of two substances: the outer portion, called *cortical* or *granular;* the inner one, *tubular* or *medullary*.

The cortical part, of a red colour, is about two lines thick, and sends prolongations inwards, between the medullary cones. It consists of an immense number of small granules, which give origin to the urinary tubes; also of the minute ramifications of the renal artery, which terminates in them, and secrete the urine. In this part, the urinary tubes are tortuous, and are continued into the tubular portion. These several parts are so delicate that they require microscopical examination, without which, some anatomists state that the cortical part consists solely of the minute ramifications of the renal artery.

The medullary or tubular part consists of the tubuli uriniferi, which are arranged in straight lines and in conical bundles, the base of which, faces externally, the apex towards the pelvis of the

kidney. These cones are about ten or twelve in number; their apex is called the *mammella* or *papilla*, which is surrounded by a membranous tube, called *calyx*. These *calices*, by uniting, form three or four large tubes, named *infundibula*, which open or dilate into the large fissure of the kidney, called *pelvis*. The pelvis of the kidney, in respect to the artery and vein, is behind and below. The emulgent vein is anterior, and the renal artery between them.

The kidneys are supplied with blood by the renal arteries, which divide into five or six branches before entering into their substance. These branches pass between the medullary cones, and terminate in capillary ramifications around the commencement of the urinary tubes.

The right renal artery is the longest, having to pass behind the vena cava to its distribution.

The renal veins, also called emulgent, empty their contents into the inferior vena cava; the left one is longest, having to cross over the aorta. It generally receives the left spermatic vein.

The nerves are from the renal plexus of the sympathetic.

The *lymphatics* are numerous, and pass into the thoracic duct.

The renal *capsules* are flattened bodies, resting on the upper extremity of each kidney. They are convex above and concave below; yellowish on the outside, browner inside, and generally have a cavity containing fluid. They are larger in the fœtus, and until the third month of fœtal life exceed the kidney in size, but are diminished at birth, and gradually decrease in size with age.

They have sometimes an artery direct from the aorta; their veins terminate in the vena cava on the right, and in the emulgent vein of the left side. The use of them is not known.

The *ureters*, continuous tubes from the pelvis of the kidney, are about eighteen inches in length. They descend behind the peritoneum, over the psoæ muscles and large iliac vessels, enter the pelvis, and perforate the coats of the bladder, along which they run for about an inch, and terminate in the bladder, about an inch from its cervix, forming the posterior angles of the trigonum vesicæ.

They are of about the size of a goose-quill, have two coats, the outer one fibrous, and the thin lining mucous coat: the narrowest part is between the coats of the bladder.

In the male, they are crossed at their upper part by the spermatic vessels; lower down they cross the umbilical artery, or the cord which is left by it, the obturator vessels, and vas deferens. The latter hooks round the ureter, to reach the vesicula seminalis of its corresponding side.

In the female, they are crossed by the spermatic vessels, the Fallopian tubes, and broad ligaments; they run along the sides of the vagina, and when in the coats of the bladder are in close relation with the neck of the uterus.

PELVIC VISCERA.

The male pelvis contains the *bladder*, *prostate gland*, *vesiculæ seminales*, *vasa deferentia*, and the *rectum*.

In the female pelvis are the *bladder*, the *uterus*, with its appendages, and the *rectum*.

The *urinary bladder* is a musculo-membranous bag, situated in the fore part of the pelvis, behind the symphysis pubis; but, when distended, it partly rises into the abdomen; and, when much distended, rises almost as high as the umbilicus.

It is divided, for the sake of description, into a fundus superior, a body, the inferior fundus, and the cervix.

Its coats are three; a partial *peritoneal* one, which covers the fundus, back part, and sides; the *muscular*, and the *villous* or lining mucous coat. The muscular coat consists principally of two layers of fibres, longitudinal outside, and circular inside. The circular fibres are very evident, near the neck of the bladder, and are by some named the sphincter vesicæ: the muscular coat, taken altogether, has been called *detrusor urinæ*. The mucous coat is thin and pale, and has a smooth appearance when the bladder is distended, but, when empty, it is thrown into rugæ: a triangular portion always smooth, bounded posteriorly by the opening of the ureters, laterally by the vesiculæ seminales, and anteriorly by the orifice of the urethra, is named the *trigonum vesicæ*. It is in this spot that the bladder may be perforated per rectum. The anterior part of this triangle sometimes presents an elevation, which has been called *uvula vesicæ*: it appears only to coexist with a diseased state of the prostate gland.

The openings into the bladder are the anterior one from the urethra, and the two posterior and lateral, viz. orifices of the ureters.

The arteries are from the internal iliacs; the

veins unite with the large iliac veins, and the nerves are from the sympathetic and sacral.

The bladder is kept in its situation by ligamentous fibres, which have received particular names. It is attached superiorly and laterally to the pubis by processes of the pelvic fascia, called *anterior ligaments;* laterally and inferiorly it receives fibres from the pelvic portion of the fascia iliaca, under the name of *lateral ligaments.* The false ligaments are five ; two posterior, two lateral, and superior. They are reflexions of peritoneum. The posterior folds of peritoneum pass from the bladder towards the fore part of the rectum; they contain the ureters and obliterated umbilical arteries.

The lateral folds extend to the iliac fossæ, containing the vas deferens in the male, and the round ligaments of the female.

The superior fold is the reflexion of the peritoneum upwards, upon the urachus and obliterated umbilical arteries.

GENITAL ORGANS.

The *testes* are two glandular bodies, situated in the scrotum, separated from each other by a cellular substance, called the septum scroti.

The coverings of the testicle are the *scrotum, dartos, superficial fascia, tunica communis, tunica vaginalis,* and *tunica albuginea.*

The body of a testicle is composed of an immense number of whitish tubes, called *tubuli seminiferi,* which are collected in bundles, and transmit or give off the vasa recta, which, at the

posterior border of the testes, form the rete testis; from this the tubes ascend, and terminate in the vasa efferentia or coni vasculosi, which perforate the tunica albuginea at its upper part, and being convoluted, there form the globus major. The vasa efferentia all terminate in the vas deferens, which forms, by its convolutions, part of the globus major and the globus minor: it then ascends, and assists in forming the spermatic cord.

The *spermatic cord* is composed of the spermatic artery and veins, the spermatic nerves, lymphatics, and the vas deferens, which are connected together by cellular substance, and covered by the cremaster muscle.

The arteries of the testes are the two *spermatic arteries*, which arise from the aorta. Sometimes the right spermatic artery arises from the right renal artery.

The right *spermatic vein* terminates in the inferior cava, and the left in the left renal vein. The nerves of the testicle are principally from the renal and lumbar plexus.

The *vas deferens*, passing upwards from the epididymis, through the abdominal ring, crosses over the psoas muscle and iliac vessels, and, descending in the pelvis, gets to the side of the bladder, to which it closely adheres, and gradually approaches its fellow of the opposite side; it communicates with the vesicula seminalis of the same side.

The *vesiculæ seminales* are two small oblong membranous reservoirs, situated at the lower and under part of the bladder. Each vesicula is formed by the convolutions of one tube, which, uniting with the vas deferens, forms the *ductus*

ejaculatorius communis, and this pierces the prostate gland, and opens into the urethra by the side of the veru-montanum.

The prostate gland is a firm glandular body, somewhat of the shape of a horse-chesnut, situated at the neck of the bladder; through its substance the urethra passes. Its ducts, ten or twelve in number, open into the urethra.

The *uterus* is a hollow viscus, situated in the female pelvis, between the bladder and rectum. It is divided into a *fundus*, *body*, and a *cervix*.

It is composed of three coats: an external or *peritoneal* covering, a *muscular*, and a *mucous* coat.

It has three openings into it: two at the angles of its fundus, leading to the Fallopian tubes; and one at its neck, leading to the vagina.

The appendages of the uterus are, the *ligamenta lata*, *ligamenta rotunda*, *ovaria*, *Fallopian tubes*, and *vagina*.

The *ligamenta lata* are two doublings of the peritoneum, sent off from the sides of the uterus to be attached to the sides of the pelvis. They contain and support the *ovaria*, *Fallopian tubes*, *ligamenta rotunda*, and the *vessels* and *nerves* of the uterus.

The *ligamenta rotunda* are two long roundish cords arising from the upper and anterior part of the uterus, in front of and below the Fallopian tubes. They pass through the abdominal rings, and are lost upon the pubes. They have a fibrous appearance, contain several small vessels, and are even supposed by some to be muscular. They serve to keep the uterus in its position.

The *ovaries* are two oval bodies, situated in the

ligamenta lata, and connected to the uterus by small ligaments. They consist of numerous vesicles, called vesicles of De Graaf. In coition, a vesicle is supposed to be detached, and its place supplied by a new deposit of a yellow appearance, which has been named corpus luteum.

The *Fallopian tubes* are two small tubes, proceeding from the angles of the uterus towards the lateral part of the pelvis. Their outer extremities are expanded in the form of a membranous fringe, called corpus fimbriatum. They are open at their extremities into the abdomen, which affords the only instance of direct continuation of mucous and serous membranes.

The *vagina* is a musculo-membranous canal, extending from the neck of the uterus to the pudendum. It is most covered by peritoneum at its upper and back part, where the peritoneum forms a cul-de-sac. Internally, it is lined by a mucous membrane.

The uterus and its appendages are supplied with blood by the uterine and spermatic arteries.

Its nerves are from the *lumbar*, *sacral*, and *great sympathetic*.

PARTS PECULIAR TO THE FŒTUS.

In the fœtus, until about the sixth month, a membrane, called *membrana pupillaris*, closes up the pupil of the eye; it is attached to the loose edge of the iris, and disappears some time before birth.

The *thymus gland*, situated in the anterior me-

diastinum, is very large: it gradually diminishes the first year after birth.

The parts peculiar to the fœtal circulation are, the *foramen ovale* of the heart; *canalis arteriosus; ductus venosus;* the *funis,* or *umbilical cord;* the *umbilical vein,* and the two *umbilical arteries.*

The *foramen ovale* is an opening of communication between the two auricles.

The *canalis arteriosus* forms the medium of communication between the pulmonary artery and aorta.

The *ductus venosus* passes from the umbilical vein to the inferior vena cava.

The *umbilical vein* passes from the umbilicus to the liver.

The *umbilical arteries* arise from the internal iliacs, and pass to the umbilicus.

The *umbilical cord* consists of the umbilical vein and two umbilical arteries; it passes from the placenta of the mother to the umbilicus of the child.

THE SKIN.

The skin is a membrane which covers the whole surface of the body, and is reflected inwards by all the natural openings, so as to line by internal reflexions, the eye, the nasal fossæ, the mouth, the air-passages, the alimentary canal, and the urinary passages. These internal portions change their character, becoming soft and moist, and are generally known as mucous membranes.

The colour of the skin differs in the human race, varying in shade from black to white.

It is composed of three layers: the *cutis vera*, the *rete mucosum*, and *cuticle*. It is likewise studded with follicles, and has appendages, such as horn, hair, and nails.

The *cutis vera* forms nearly the entire thickness of the skin, of which it is the deeper-seated layer. It is composed of dense cellular tissue, mixed up with aponeurotic fibres, crossing each other in every direction. Its inner surface is areolar, and appears to be a continuation of the cellular tissue itself. Its outer surface is studded with numerous papillæ, or little cone-shaped eminences, in which the vessels and nerves terminate. The cutis vera is elastic, but strong. It is thick on the back, on the posterior part of the limbs, in the palms of the hands, and soles of the feet; but exceedingly thin on the eyelids and genitals.

A thin muscular layer is found immediately beneath, and connected with it, in animals, called the *panniculus carnosus*.

The *rete mucosum* forms a layer of substance nearly liquid, seated between the cutis vera and cuticle. It is very thin, and colourless in the white portion of the human race, but forms in the black a dark covering, quite distinct. The colour of the skin principally depends upon it. It seems to be secreted by the vessels of the cutis vera.

The epidermis adheres to the mucous layer and to the cutis vera by a number of filaments which appear to be only elongations, which penetrate the pores and crevices of the skin. Pores are observed in it, which give passage to the perspiratory fluid.

The epidermis is not an organized body, for no nerves or vessels have ever been traced to it. It

may rather be considered as a covering resulting from the drying of the external layers of the rete mucosum. It is thickest in the palms of the hands and soles of the feet, where it appears to consist of several layers.

PHYSIOLOGY.

OF THE NUTRITIVE FUNCTIONS.

Mastication and insalivation.—The food being taken into the mouth, is retained there and brought under the influence of the teeth by the lips, the buccinator muscles, and tongue. By the lateral motions of the lower jaw, effected by the pterygoid and assisted by the masseter muscles, the inferior molar teeth grind the alimentary substance against the upper ones. During this time the food becomes mixed with the saliva and mucus of the mouth, which convert it into an easily-swallowed bolus, and also fit it for digestion and assimilation.

Deglutition.—When the food has been sufficiently divided and imbued with saliva, it is placed in a mass upon the dorsum of the tongue, which is rendered concave for its reception. The mouth is then closed, the apex of the tongue applied to the roof of the mouth, and the rest of the organ brought successively in contact with it, from before backwards; the food having no other way to escape this pressure, slides down on the inclined plane formed by the tongue, through the

isthmus faucium, into the pharynx, which is drawn upwards and forwards to receive it. At this time the *velum palati* is elevated, and thus prevents the food getting into the nostrils or Eustachian tubes. The larynx is raised, and rather inclined forwards, at the same time that the pharynx is elevated, so that the glottis is brought under the epiglottis, which amply covers it, and thereby prevents the food from entering that cavity. As soon as the food has passed the isthmus into the pharynx, the velum is depressed, and thus cuts off the return of food into the mouth, at the same time that it assists in its descent. The moment the food has passed into the pharynx its constrictors begin to act, and rapidly force it into the œsophagus. The larynx, pharynx, velum, &c. are now restored to their natural position.

Digestion.—The alimentary matter being propelled by the contractions of the œsophagus into the cardiac extremity of the stomach, becomes acted upon by the gastric juice, which, assisted by the heat and muscular contraction of the stomach, quickly dissolves the digestible part, and entering into union with it, produces a new fluid, called *chyme.* The chyme is gradually conveyed, by a kind of peristaltic motion, from the cardiac to the pyloric end of the stomach. When it has been sufficiently operated upon by the stomach, it passes through the pylorus into the duodenum. The pylorus possesses a peculiar sensibility, which may be considered as a kind of sentinel, that prevents any matter from passing through it but such as has been properly converted into chyme.

Chylification.—The chyme having passed through the pylorus into the duodenum, becomes

mixed with the *biliary*, *pancreatic*, and *intestinal* secretions. These juices, by their action upon the *chyme*, separate it into two portions, one a milky fluid, called *chyle*, and another, the excrementitious portion. By some, the alkaline and saline ingredients of the bile are supposed to combine with the chyle, while the albumen and resinous matter combine with the excrementitious portion. The chyle attaches itself to those irregular circular folds of the mucous membrane of the small intestines, called valvulæ conniventes, where it is absorbed by the lacteals, and conveyed to the thoracic duct. The large intestines also possess lacteals, so that if any portion of chyle should not have been absorbed in the small intestines, it is taken up in the large ones. The fæces pass from the small to the large intestines and there acquire that peculiar fœtid odour which distinguishes them. They are gradually urged on into the sigmoid flexure of the colon and rectum, where they remain for a certain time, and are then discharged.

Excretion of the fæces.—The fæces gradually accumulating in the rectum stimulate it to discharge its contents; the levator and sphincter ani then relax, and the diaphragm and abdominal muscles expel the fæces. After the excretion, the levator chiefly retracts the intestine, which is again closed by its sphincter.

Absorption and course of the chyle.—The absorbents which take up the chyle in the intestines are called *lacteals*. They are most numerous in the jejunum. The lacteals of the small intestines, and part of the large, convey the chyle to the mesenteric glands, where it is supposed to undergo some change, which is rendered evident by a

change of colour; the fluid which passes from the gland has a more pink and rather less milky appearance. Passing from one gland to another, they form two or three, sometimes more, large trunks. These accompany the superior mesenteric artery to the right side of the aorta, and there join the thoracic duct. The thoracic duct is formed by the junction of the lacteals with the lymphatics of the pelvis and lower extremities. It begins on the third lumbar vertebra, and here swells out into an oval sac, called *receptaculum chyli.* Proceeding upwards, on the right side of the aorta, it passes through the aortic opening of the diaphragm into the posterior mediastinum. On the fourth dorsal vertebra it crosses behind the aorta to reach the left side of the neck, and terminates in the angle of union of the subclavian and internal jugular veins.

Use of the spleen.—The physiology of the spleen is not understood. By some it has been thought subservient to the function of the liver, by preparing a fluid for the vena portæ. Others consider it subservient to the stomach, and that it receives the surcharge of blood when the stomach is empty. The most rational theory is that of Mr. Dobson: he found that the spleen receives most blood during digestion, and that, when digestion is completed, it recovers its normal condition. Hence he imagined that the spleen becomes a reservoir or diverticulum for a part of the blood, until the system can accommodate itself to the additional fluid which has been thrown into the circulating mass of fluids. Some modern physiologists imagine that the spleen is subservient to producing the colouring matter of the blood,

and that it indeed may be said to form the red globules: this is rather a fanciful opinion.

Circulation of the blood.—The blood is returned from the upper part of the body by the superior vena cava, from the inferior part by the inferior cava, and from the heart itself by the coronary vein to the right auricle. This contracts and discharges its contents into the right ventricle: when completely filled, the right ventricle contracts; by that contraction, its tricuspid valve is brought into action, and prevents the blood returning into the auricle, and the contents are propelled through the pulmonary artery and its ramification to the lungs. From the lungs the blood is returned by the four pulmonary veins to the left auricle, which, being distended, now contracts, and throws the blood into the left ventricle. The left ventricle then contracts, its mitral valve closes the opening, and the blood is propelled through the aorta into the capillary system, to be again returned by the veins. The aorta and pulmonary artery are each guarded by three semilunar or sigmoid valves, which prevent the blood returning into the ventricles.

Of respiration.—The air is received into the lungs by the enlargement of the cavity of the chest. The powers which effect this enlargement, in common inspiration, are the diaphragm and intercostal muscles; in forced inspiration, many other muscles are brought into play, such as the pectoralis major and minor, subclavius, scaleni, serrati postici, serratus magnus, and latissimus dorsi. The blood of the pulmonary artery being exposed to the influence of the air in the lungs, is converted from a dark colour into a florid red; it is consi-

dered to be decarbonized, that is, carbon is emitted, which, combining with the oxygen of the inspired air, forms carbonic acid : a watery vapour is likewise evolved. Others consider that oxygen is absorbed, and that carbonic acid, already formed in the blood, is evolved. When the blood has been properly acted upon, the inspiratory muscles relax, while the abdominal muscles, pressing the viscera upwards against the diaphragm, diminish the cavity of the chest, and thus expel the air. In forced expiration several muscles assist; they are the triangularis sterni, serrati postici inferiores, levator ani, quadrati lumborum, latissimus and longissimus dorsi.

Of the fœtal circulation.—The ramifications of the umbilical vein return the blood conveyed by the uterine arteries to the placenta, and carry it by the umbilical vein through the umbilicus into the abdomen of the fœtus. At the transverse fissure of the liver, the vein divides into branches, most of which convey the greater part of the blood through the liver, whilst one, called *ductus venosus*, passes direct to the inferior vena cava, from which the blood passes into the right auricle, and mixes with that from the superior cava and coronary vein. From the right auricle it passes partly into the right ventricle, and partly through the foramen ovale into the left auricle. That portion of blood which passes into the right ventricle is transmitted into the pulmonary artery, which sends part of it to the lungs, but the greater part to the descending aorta, by the *canalis arteriosus*. The blood which is sent into the lungs is returned by the four pulmonary veins to the left auricle, there mixes with the blood received through the

foramen ovale, and then passes into the left ventricle, whence it is transmitted into the aorta, where it mixes with the blood brought by the canalis arteriosus, and is distributed through the whole system, and is brought back by the veins. The blood is returned to the placenta by the two umbilical arteries, which are continuations of the hypogastric arteries, branches of the internal iliacs.

More modern anatomists describe the fœtal circulation differently. They say that the blood of the inferior cava (which is the purest) passes into the right auricle, thence through the foramen ovale, into the left auricle, and thence into the left ventricle; thence to the aorta to supply the head and upper extremities; the blood from the head and upper extremities is brought to the right auricle, which it traverses, and passes into the right ventricle, then into the pulmonary artery, to the lungs and ductus arteriosus, from which it enters the aorta to supply the lower part of the body, and to be conveyed to the placenta by the umbilical arteries.

This kind of circulation is highly probable, when we take into consideration the superior development of the head and upper extremities, the situation of the eustachian valve, and the peculiar direction in which the ductus arteriosus enters the aorta: this is the description which is now more generally received.

The temperature of the blood is about 98°. The cause of it is imperfectly understood. Some attribute it to the caloric evolved in the lungs, arising from the union of oxygen with carbon, and say that it is carried by means of the blood to the

different parts of the body; others consider that caloric is evolved in the general capillaries at the time of the conversion of the arterial into venous blood. Sir B. Brodie considers that the nervous system is mainly concerned in the production of animal heat.

OF SECRETION.

The term secretion is applied to that process by which parts of the blood are separated in the various organs. The manner in which secretion is effected is perfectly unknown.

The secretions may be divided into *exhalations*, *follicular secretions*, and *glandular secretions*.

A distinction is made by some between secretions and excretions, in this way, viz. a secretion is something which is capable of causing changes in other parts before it leaves the body; an excretion is something thrown off from the body as useless, and even injurious, and although retained some time produces no beneficial change in other fluids or solids.

Of the secretion and excretion of the tears.—The tears are secreted by the lacrymal gland, from whence they are conveyed by six or seven excretory canals to the upper and outer part of the eye, where they pass through the conjunctiva, and are carried by a triangular canal, formed by a meeting of the eyelids, to the inner canthus of the eye, where they are absorbed by the *puncta lacrymalia*, and conveyed by two tubes to the *lacrymal sac*. From the *lacrymal sac* the tears pass by the *nasal duct* into the inferior meatus of the nose.

Use of the tears.—The tears keep the cornea moist, prevent the friction of the eyelids on the eyes, and wash away any extraneous bodies which may have fallen into the eye.

Secretion of milk.—The milk is secreted in the glandular substance of the mammæ. The *tubuli lactiferi* commence in numerous small portions of the gland, called *granules*. As they approach the nipple, the ducts unite into twelve or fifteen, of considerable size, which terminate on the surface of the nipple by open mouths. The milk is only for the purpose of nourishing the infant.

Secretion of saliva.—The saliva is secreted by the parotid, submaxillary, and sublingual glands, and conveyed by their ducts into the mouth. Its use seems to be, to assist the mastication and deglutition of the food, and its digestion in the stomach.

Secretion of gastric juice.—The gastric juice, a fluid somewhat analogous to saliva, is supposed to be secretly parted by the extreme arteries of the villous coat of the stomach, and partly by the glands. It dissolves those substances which are nutritious to the animal.

Secretion of the pancreatic juice.—The pancreatic juice is secreted in the acini of the pancreas, and conveyed by numerous small ducts into the great pancreatic duct, which opens along with the ductus choledochus in the duodenum. It is supposed to assist in chylification, by diluting the bile, and adding to the saline ingredients.

Secretion of bile.—The bile is secreted in the liver by the minute branches of the vena portæ into the *acini;* from thence it passes along the excretory ducts, called the *pori bilarii,* into the

hepatic duct; this, with the cystic duct, forms the *ductus communis choledochus,* which terminates in the duodenum. It is said by some that the blood of the vena portæ, having more carbon and hydrogen than that of the hepatic artery, is more proper for furnishing the elements of the bile.

Excretion of bile.—When digestion is not going on, the opening of the *ductus choledochus* is closed by the contraction of the duodenum; and the bile therefore, not finding access into it, regurgitates into the gall-bladder, where it acquires greater consistence. When the duodenum is distended with chyme, the irritation it produces is propagated to the gall-bladder, the parietes of which contract, and force the bile along the cystic duct into the ductus communis choledochus, and from thence into the duodenum.

Use of the bile.—The bile precipitates the fæces from the chyle, and excites the peristaltic motion of the intestines; it is also considered to be an outlet for carbon and hydrogen from the body.

Secretion of urine.—The urine is secreted by the minute branches of the renal artery into the *tubuli uriniferi:* then passes through the *papillæ* or *mammary processes,* into the *calices* or *infundibula.* These uniting, form three or four principal tubes, which terminate in the *pelvis* of the kidney. The pelvis contracting forms the ureter, which carries the urine to the bladder.

The oblique manner in which the ureters penetrate the bladder prevents the urine from returning; the inner membrane of the bladder lying over the opening produces the effect of a valve.

Excretion of urine.—As soon as there is a cer-

tain quantity of urine in the bladder, we feel an inclination to discharge it. This we effect partly by the contraction of the bladder itself, and partly by the action of the abdominal muscles and diaphragm, which press the intestines against the bladder. The urine is the principal outlet for nitrogen.

Secretion of semen.—The semen is secreted by the minute branches of the spermatic arteries in the testicles. It passes through the *tubuli seminiferi* into the *vasa recta;* these, by their communications, form partly the *rete testis.* From the rete testis the semen passes by the *vasa efferentia* into the *coni vasculosi,* forming the head or *globus major* of the epipidymis; then through the body of the epipidymis into its lower part, called *globus minor* or *cauda,* in the convoluted *vas deferens.* The vas deferens opens with the *vesicula seminalis* into the urethra.

Use of the vesiculæ seminales.—They are generally supposed to receive the semen, and to effect some change in it. By some they are considered to secrete a peculiar fluid.

Use of the prostate gland.—The prostate gland secretes a peculiar fluid, which is discharged into the urethra by ten or twelve ducts. This secretion is combined and discharged with the seminal fluid.

Use of the uterus.—The uterus is of service for the function of *menstruation,* and for the reception and nutrition of the *ovum.*

During coition the uterus is supposed to open a little, and draw in the semen by aspiration; the Fallopian tube directs it to the ovarium: the contact of the semen determines the rupture of

one of the ovarian vesicles, which passes into the uterus. Some authors imagine that it is not the semen that is carried to the ovarium, but only the vapour that exhales from it, or *aura seminalis.* Others think the semen is absorbed, and carried to the ovaria by means of the arteries. No theory yet started carries much probability with it.

OF THE BRAIN AND ORGANS OF SENSE.

Of the physiology of the brain.—The uses of the brain in the animal economy are very numerous and important. It is the material organ of the *intellect* or *mind;* it gives, through the medium of the nerves, the power of *voluntary motion;* it is the seat of *sensation* and of *sympathies,* and exerts more or less influence upon all the vital phenomena.

The *sensations* are those functions destined to receive the impression of external objects, and to transmit them to the intellect.

They are five in number, viz. *vision, hearing, smell, taste,* and *touch.*

Mechanism of vision.—The rays of light, emanating from surrounding objects, which fall on the cornea, are in part reflected, and thus contribute to form the brilliancy of the eye. The transparent cornea refracts the remaining rays, and thus increases the intensity of light; the rays then pass through the anterior chamber, pupil, and posterior chamber to the lens. The number of rays which fall on the lens is regulated by the iris, which contracts or dilates, to allow more or less light to

pass through the pupil, according as an object may be more or less lighted. Those rays that fall on the iris are reflected, and, returning through the cornea, exhibit the colours of the iris. The crystalline lens, both from its structure and form, very powerfully refracts the rays, and collects them into a focus, in the vitreous humour; from which point they diverge, and are spread out upon the retina in the bottom of the eye, where the impression is received, and conveyed along the optic nerve to the brain, and produces *vision*. The object is depicted in an inverted manner.

The *conjunctiva* protects the anterior surface of the eye; it secretes a fluid which mixes with the tears, and seems to have the same use; it supports the pressure when the eye is moved, and being always polished and humid, it gives much facility to motion.

The *sclerotic* is evidently to protect the interior parts of the eye, and to serve besides as a point of insertion for the muscles that move the eye.

The *choroid* membrane is the most vascular coat of the eye, allowing the ramifications of the vessels, and secreting the pigmentum nigrum.

The *pigmentum nigrum* absorbs the light after it has traversed the retina, and thus prevents dazzling.

The dark matter, called *uvea*, on the posterior surface of the iris, is to absorb those rays that may be reflected by the polished surface of the crystalline.

The use of the *ciliary processes* is not perfectly understood. By some they are considered to secrete the aqueous humour. Haller thinks that they maintain the lens in the most advantageous

position. Some physiologists think that they are muscular, and are able to produce changes in the convexity of the lens.

The *eyebrows* guard the eyes from external violence by the projection which they form; they protect the eyes from too much light, particularly when it comes from above, and they prevent perspiration from flowing towards or irritating the surface of the eye.

The *eyelids* during sleep cover the eyes, and thus preserve them from the contact of any foreign bodies floating in the air; they moderate the force of a too brilliant light; and, by their regular and habitual motion, preserve the eyes from the effects of the continued contact of the air: and, by their sudden closure, guard them from any shock.

The secretion from the *meibomian glands* facilitates the motion of the eyelids.

Hearing.—The external ear, or *pinna*, collects the sonorous undulations, and directs them towards the *meatus auditorius externus*. This trumpet-like tube concentrates and conveys them to the *membrana tympani*. The sonorous waves striking against this membrane cause it to vibrate; this vibratory motion will be also given to the *malleus*, which is in contact with the membrane. The malleus moves the *incus;* the incus, the *os orbiculare;* and this latter moves the *stapes*. Now the base of the stapes being attached to the membrane closing the *fenestra ovalis*, it is evident that the stapes must act the part of a piston; that is, compressing or dilating the fluid in the *vestibule*, *semicircular canals*, and *cochlea*. The motion of this fluid conveys the impression to the

acoustic nerve which lines the labyrinth. This nerve, receiving the impression, conveys it to the brain.

The *Eustachian tube* admits the free passage of air into and from the cavity of the tympanum, thus preserving a due balance with the external air, and enabling the membrana tympani to move in obedience to the slightest impression.

The *mastoid cells* are supposed to augment the intensity of the sound.

The *fenestra rotunda* and *aqueducts* are supposed to allow the liquid of the labyrinth to suffer vibrations.

Of taste.—To produce the sensation of taste, the food must be moistened and applied to the tongue. The minute branches of the *lingual* branch of the third division of the fifth pair, receive the impression, and convey it to the brain.

Of smell.—The air, filled with the odorous effluvia which exhale from most bodies, being received into the nostrils by inspiration, carries these particles to the olfactory nerve, which is expanded over the surface of the pituitary membrane. By these means a kind of sensation is produced, which we call smell. Mucus is secreted to preserve the extremities of the nerves, and to lessen the too strong impression that would arise from the immediate contact of the odoriferous particles.

Of the functions of the skin.—The *cutis vera*, or true skin, forms the organ of touch, besides which it is a medium for absorption, and has a function analogous to that of the lungs, namely, the discharge of useless carbon from the system. The carbonic acid produced in the process is

formed by the union of the carbon with the oxygen of the atmosphere.

The *cuticle*, or *epidermis*, seems to blunt the otherwise too acute sensibility of the cutis vera, and to protect it from the impression of external bodies.

Of the voice.—The air expelled from the lungs passes through the trachea and larynx. In the latter, the passage for it is much smaller than in the trachea, and the air is forced through a narrow slit, the two sides of which are vibrating planes, and which then produce sonorous undulations in the transmitted current of air. The intensity of the sound depends on the length of the *chordæ vocales*, the distance between them, and the force with which the air is expelled. The modifications of the voice depend upon the alterations produced on the opening of the glottis by its muscles and ligaments; and articulation, upon the movement of the muscles of the mouth and palate.

PRACTICE OF MEDICINE.

HEADS OF PRINCIPAL DISEASES TREATED OF.

INFLAMMATION.

FEVERS.

Intermittents.
Remittents.
Continued Fevers.
Synocha.
Typhus.
Synochus.
Hectic Fever.

Eruptic Fevers.
Scarlatina.
Rubeola.
Variola.
Varicella.
Miliaria.

DISEASES CONNECTED WITH THE DIGESTIVE SYSTEM.

Aphtha.
Cynanche Tonsillaris.
——— Maligna.
——— Pharyngea.
Dyspepsia.
Hæmatemesis.
Colica.
Vermes.
Peritonitis.

Gastritis.
Enteritis.
Diarrhœa.
Dysentery.
Cholera Morbus.
Hepatitis.
Icterus.
Splenitis.

DISEASES OF THE RESPIRATORY ORGANS.

Catarrhus.
Bronchitis.
Laryngitis.
Croup.
Pertussis.

Pneumonia.
Pleuritis.
Hæmoptysis.
Phthisis.
Asthma.

DISEASES OF THE CIRCULATORY SYSTEM.

Angina Pectoris.

Carditis.

DISEASES OF THE BRAIN AND NERVOUS SYSTEM.

Meningitis.
Phrenitis.
Hydrocephalus.
Apoplexia.
Paralysis.
Tetanus.
Epilepsia.
Chorea.
Hysteria.

DISEASES OF THE SKIN.

Erysipelas.

DISEASES OF THE URINARY AND GENITAL ORGANS.

Nephritis.
Cystitis.
Hysteritis.
Hæmaturia.
Chlorosis.
Menorrhagia.

DISEASES PRINCIPALLY ATTACKING FIBROUS AND SYNOVIAL MEMBRANES.

Podagra.
Rheumatismus.

HYDROPES.

Anasarca.
Ascites.
Hydrothorax.

INFLAMMATION.

The signs of external inflammation are pain, heat, redness, and swelling.

Internal inflammation is judged of by the local pain increased upon pressure; the functional disorder and general derangement of the system; and the blood, when drawn, is generally more or less buffy.

The exciting causes are mechanical and chemical irritants, cold, morbid poisons, and metastasis.

The pain in inflammation is produced by pressure or distension of the nervous filaments, which probably possess at that time a greater degree of sensibility.

The heat may depend upon the increased quantity of blood in the part, the rapidity of the changes which take place in the blood, and some peculiar power of the nerves.

The redness is occasioned by the accumulation of the blood in vessels which previously carried only the colourless parts of the blood. It is the opinion of some, that the red particles do not enter vessels which did not contain them previously, but that in a healthy state they passed through these same vessels in smaller number, so as not to be distinguishable by ordinary observation; and that, in disease, they enter in larger number.

The swelling is effected by the accumulation of blood, and the effusion of serum or lymph, into the surrounding cellular tissue; the action of the absorbents being, at the same time, somewhat suspended.

Inflammation terminates by resolution, effusion, induration, suppuration, ulceration, and gangrene.

Resolution implies a subsidence of the inflammation, without any apparent organic alteration.

In suppuration a new fluid named pus is formed. Its formation internally is preceded by rigors, the pain becomes of a throbbing kind; there is a sensation of weight in the part: when it is formed, the pulse continues frequent, but is softer and more compressible; night sweats and hectic fever often supervene.

In ulceration, there is an increased action of the absorbent vessels, which remove a portion of the living solids. This process is of service in separating the dead from the living parts.

When gangrene or sphacelus takes place, it is

known by the sudden cessation of pain, a sinking irregular pulse, a cadaverous countenance, and delirium; where it occurs externally, the parts which were red, become livid, and of a dark dusky colour, vesications take place, and there is a peculiar fœtor given off from the body. Gangrene and sphacelus are terms often employed to distinguish two degrees of mortification: gangrene is used to imply that a part is dying, but recoverable; sphacelus means that a part is totally deprived of vitality.

FEVERS.

General character of fevers.—There is, at first, a sensation of chilliness with cold surface, probably dependent upon internal congestion, succeeded by increased heat, a full pulse, a flushed countenance, thirst, debility, languor, and pain in the limbs, loss of appetite, nausea, vomiting, and restlessness. The tongue is furred, and the different secretions are disordered.

Cullen divides fevers into idiopathic and symptomatic; some others arrange them in five classes, consisting of intermittents, remittents, continued fevers, hectic fever, and fevers with eruptions.

Fevers may depend upon three principal causes: first, inflammation of an acute or subacute character of some viscus or tissue of the body; secondly, upon some functional derangement without evident inflammation; and thirdly, upon mere loss of balance of the circulation.

Intermittents.

Intermittents are diseases in which there are distinct paroxysms of fever, between which there is an apparently perfect intermission, or period free from fever.

There are three general kinds of intermittents, the *quotidian*, *tertian*, and *quartan*. Besides these, several varieties of an irregular type, which are named irregular tertian, quartan, &c.

In the *quotidian*, the febrile paroxysm recurs daily in the morning, and is in general the longest.

In the *tertian*, the paroxysm takes place every second day, towards the forenoon. The hot fit is generally the longest.

In the *quartan*, the paroxysm recurs every third day in the afternoon. The cold stage is the longest and most violent.

The average duration of a paroxysm is about six hours.

Causes of intermittents. — The predisposing causes are, cold, combined with moisture, debility of the system from low diet, fatigue, preceding disease, and anxiety of mind. The common *exciting* cause is considered to be the effluvium from marshy soils, called *marsh miasm*, which may be produced by the putrefactive process going on in vegetable substances.

The paroxysm of an intermittent is distinctly marked by three stages: the cold, the hot, and the sweating.

In the *cold stage*, a sensation of cold is first felt in the extremities, and subsequently extends over

the whole body; the blood leaves the surface, there is a pale constricted skin, great languor and listlessness, hurried respiration, oppression at the præcordia, diminished secretions, a small, frequent, and sometimes irregular pulse; the teeth chatter, the limbs tremble, and there is a convulsive shaking of the whole body.

The duration of a cold stage is variable, but may last from one to four hours.

Hot stage.—After an uncertain space of time, reaction comes on, with heat, which gradually extends over the whole body. The sensibility, from being as it were benumbed, becomes acute; the pulse is quick, strong, and hard; the tongue white; the urine scanty and high coloured; there is nausea and vomiting, confusion of intellect, and sometimes delirium. The duration of this stage is generally longer than the preceding.

Sweating stage.—After an uncertain time, a moisture breaks out upon the face and neck, and by degrees extends over the whole surface. The febrile symptoms gradually diminish; the pulse becomes natural; the feeling of weakness goes off: the heat of the skin, thirst, and headach diminish; the appetite returns, and the secretions are restored to their healthy condition.

In the cold stage, the symptoms produced may be referred to the accumulation of the blood in the vessels of the brain, the heart, lungs, and abdominal viscera. In the hot, the heart becomes excited after congestion, producing febrile symptoms, which are relieved in the sweating stage by the blood separating a portion of its thinner parts, forming the profuse perspiration, which

may be of great service in cooling the surface of the body.

The accumulation of the blood in the large vessels and deep-seated organs is explained in two ways: some attribute it to a weakened, passive state of those vessels and organs which are unable to relieve themselves from the accumulation; others, and amongst them the late Dr. Mackintosh, consider that the congestion arises from an active condition of system, viz. the capillaries becoming unusually contracted, almost spasmodically, refuse to admit the blood to the surface of the body. When this contraction ceases, from the withdrawal of sufficient stimulus, the blood re-enters the vessels, and the heart and lungs being relieved from the surplus, begin to act with increased impetus, and thus occasion the hot stage.

Treatment of intermittents.—In the treatment of these fevers there are two objects in view: the one, by palliative means, to modify and shorten the paroxysms; the other, which is curative, to prevent their return. The indication in the cold stage, is to restore the natural warmth to the body, to shorten the paroxysm, and to bring on the hot stage. This is usually attempted by applying heat externally, giving stimulants and diaphoretics, using the foot-bath, and by warmly covering the patient up in bed.

Another mode of treatment, suggested and practised by Dr. Mackintosh, consists of bleeding in the cold stage, by which means an immediate relief of the urgent symptoms is felt, and the paroxysm is often entirely superseded. This mode

of treatment is said to have been even successful where all other remedies have failed, and is most likely to do good in robust individuals, and where there is not settled organic disease. The quantity of blood necessary to be drawn varies considerably, viz. from four to twenty ounces.

In the hot stage, means should be employed to lower the temperature. Cold acidulated drinks may be administered, the body may be sponged with cold water, and the greater portion of the bedclothes removed. Bleeding will become necessary, in case of any local determination or inflammation.

In the sweating stage caution is required not to allow the body to be chilled too suddenly, and it is generally desirable to keep up the perspiration till the painful or uneasy sensations are mitigated.

Treatment during the intermission. — At this period, various vegetable and mineral tonics are administered, to prevent the recurrence of the paroxysm.

The vegetable tonics used for this purpose are *cinchona, simarouba, cascarilla* barks, and many others.

The cinchona is most efficacious, and seems to possess a specific property in arresting the paroxysms. The least common at present, but oldest form of administering cinchona, is in powder: a drachm to two drachms may be given every three or four hours, so that nearly two ounces may be given during the intermission. The sulphate of quinine is the most eligible form for administering cinchona, as it is less liable to oppress the stomach or irritate the bowels. It may be given

in doses of two or three grains every fourth hour, for twenty-four hours before the expected accession.

Should there be any inflammatory diathesis, or local inflammation, bleeding and purging must be had recourse to before cinchona is admissible, or so likely to be useful.

When intermittent fever exists, combined with great debility and without local inflammation, wine, opium, and cordials may be administered.

The liver and spleen are found to be frequently disordered in this disease; the spleen is liable to become enlarged, and is then known as the ague cake. There is often torpor of the liver, which requires the use of mercurials, for indeed, in some cases, bark completely fails, until the disorder of the liver is attended to.

The mineral tonics used in the cure of intermittents, are arsenious acid, sulphate of zinc, and sulphate of copper. Fowler's solution, i. e. liquor potassæ arsenitis, may be given in doses of from five to ten minims; but should never be tried, until the cinchona in its various forms has completely failed; for this remedy, although it may remove the ague, is apt to injure the stomach, and derange the system at large.

Remittent fevers likewise arise from malaria in many instances. They have no apparently perfect intermission, but have evident periods of paroxysms, or exacerbations.

The principal disease of this description is the yellow fever of hot countries. It is usually attended with symptoms indicating disease affecting the brain, lungs, or abdominal viscera. There is violent vomiting, consisting at first principally of

bile, afterwards of dark matter resembling coffee-grounds. The skin and conjunctiva are of a yellow tinge, and there are violent cramps in the belly and legs.

The treatment most efficacious consists in bleeding largely at the commencement, afterwards applying blisters and counter-irritants, and sponging the body with vinegar and water. Brandy and wine are sometimes administered with apparent success.

There is a form of fever, which attacks children, generally between the ages of three and ten, known as *infantile remittent fever*. Much has of late been written and said on the subject, but still medical men are divided in their opinions respecting the pathology of it. Its symptoms are, debility, hurried pulse, fever with exacerbations, dry skin, furred tongue, restlessness, starting in sleep, tumid abdomen, pallid and emaciated countenance, torpid state of the secretions and evacuations. It sometimes lasts for many week, is attended with danger, and often appears to lay the foundation of some organic disease. It is occasionally produced by worms, most commonly by stimulating or indigestible food, and sometimes connected with disease of the mesenteric glands. The most prominent morbid appearance is inflammation and its consequences in the gastro-enteric mucous membrane. The treatment most practised consists in frequent administration of purgatives to clear out the primæ viæ. Mild mercurials should be amongst the remedies; fomentations to the abdomen, the foot-bath, or general warm bath, are useful; bloodletting is seldom necessary, but must be had recourse to in any case of decided local

inflammation, especially the application of leeches upon the abdomen; in the latter stages the patient is to be supported by vegetable and mineral tonics.

IDIOPATHIC OR CONTINUED FEVERS.

Synocha, Inflammatory Fever.

Symptoms.—This fever commences with rigors and lassitude, and is followed by flushings and excessive heat. The pulse is full and frequent, the countenance and eyes suffused. There is pain in some part of the body, frequently in the head or back. The tongue is dry and coated; the urine scanty and high coloured. There is costiveness, excited sensibility, quick respiration, and great anxiety.

The precise seat of disease is very doubtful. Some authors refer it to the brain, but the greater number to the gastro-enteric mucous membrane; in many cases no lesion of either part can be discovered, so that it may be seated even in the capillaries, nervous system, or elsewhere.

Causes.—Sudden change of temperature, overexertion, alarm, the abuse of liquors, and the suppression of some usual evacuation.

Treatment.—Blood must generally be drawn from the arm, or locally, according to the age and strength of the patient, and violence of the fever. Emetics may be administered, and be followed by purgatives, especially the saline ones. Counter-irritants may be applied; and the medicines to be given for a continuance should be cool drinks,

acetate of ammonia, antimonial preparations, and in some cases Dover's powder. Great relief is sometimes experienced by sponging the body with cool vinegar and water. This is only admissible when there is excessive heat, without any apparent local congestion or inflammation.

Congestive or Typhus Fever.

Symptoms.—At first, languor, chilliness, and depressed spirits, with sighing and oppression in the breathing, followed by pain in the head, or some other part of the body; confusion of thought; vomiting; pulse quick and weak, sometimes intermittent; the tongue becomes dry, brown, and tremulous; the countenance is expressive of anxiety, and the cheeks are often tinged with a circumscribed blush; urine pale, watery, and in small quantity; muttering delirium; subsultus tendinum; sometimes diarrhœa, and involuntary excretions; and cold extremities. Exacerbations are generally observed in the evening, and relief is experienced in the morning. A change in the state of the patient, named the *crisis,* is often observed about the fourteenth day from the onset of the rigors: this may be protracted to the twenty-first day, but it is not common. The change which occurs, is perspiration, breaking out about the face and neck, and next day on the arms and other parts of the body, the sordes separates from the gums, the tongue becomes moist, the mind is collected and composed, and the pulse is softer and fuller. The feeling of debility is more perceptible by the patient at this period

than before, when he was almost unconscious of his existence: this critical period is ridiculed by many, but I am inclined to think that if it were more properly distinguished, there would be less contradiction in the methods of treating typhus fever.

Causes.—Powerful affections of the mind; exposure to cold and moisture; excessive fatigue and contagion.

Treatment.—In the commencement give an emetic, to unload the stomach, remove the congestion, and equalize the circulation. Bleed moderately from the arm, or apply eight or ten leeches to the temples; let the head be shaved, and apply cold evaporating lotions; apply a blister to the nape of the neck, or to any part where more indicated; give diaphoretics and mild purgatives, and sponge the body with vinegar and water, if the skin be very hot and parched. The horizontal posture must be insisted upon, and the patient must abstain entirely from animal food, which precautions apply to all kinds of continued fevers.

Amongst the various plans of treatment I may mention the following:

Some give mercurials to salivation, and say that whoever loses a patient with typhus without having salivated him, may accuse himself of causing the death of the patient.

Some treat the disease by active bleeding, and the use of tartar emetic.

Others treat typhus by wine and other stimulants, even from the earliest periods.

Others rely upon the saline remedies, which were advocated by Dr. Stephens in cholera.

I believe that mercury in moderation is useful;

that careful bleeding and antiphlogistics do good at the commencement, and that wine may support the heart's action when it fails, and afford time for the beneficial operations of nature and art. I have noticed that an excess of sesquicarbonate of soda in saline draughts, in the proportion of half a drachm to a drachm, on the plan of Dr. Ayre, has been eminently useful.

When the violence of the symptoms has abated cinchona, serpentary, and other tonics, and opium, to procure sleep, are requisite.

Morbid appearances.—The most frequent morbid changes observed are in the mucous coat of the stomach and bowels, particularly the ilium. The membrane is softened, the vessels are gorged with blood, the mucous follicles inflamed, and often ulcerated. The brain is sometimes softened, and its vessels unusually filled with dark blood; the pia mater and arachnoid have been seen thickened, and fluid is found sometimes in the ventricles. The lungs are often gorged with blood, and the bronchial tubes present an inflammatory appearance.

Typhus Gravior, Putrid Fever.

Symptoms.—The same as in typhus mitior at first, but run through their stages more rapidly. Symptoms of malignancy soon appear. The tongue is covered with a brown or black crust; the fæces pass involuntarily; hæmorrhage breaks out; petechiæ show themselves; the pulse sinks and intermits; the skin is cold; hiccup comes on, and death

follows. When the symptoms of prostration come on, stimulants are necessary; the best are sulphuric ether, ammonia, wine, and brandy.

Synochus or Mixed Fever.

The symptoms are the same as in synocha at the commencement, but in the latter stage resemble typhus.

The treatment must partake of that necessary for both forms of fever; bloodletting and evacuants are necessary in the commencement; but, in the advanced stage, the warm bath, stimulants, &c.

This form of fever is very common, and is in most cases the disease which passes under the name of typhus.

Hectic Fever.

The state of body called hectic fever, is a concomitant of other diseases, and generally of those in which suppuration has taken place. It is considered by some to be produced by the absorption of pus, and by others to be dependent upon inflammation and ulceration of mucous membrane, when occuring during the progress of other diseases.

Symptoms.—Rigors, mostly towards the evening, followed by heat, and succeeded by profuse perspiration, which may be brought on by any over-exertion. The perspiration is most profuse in the night, and is called night sweats. The pulse and breathing are both very much hurried.

There is a redness on the cheek, called hectic blush, and diarrhœa is a very common attendant. In this state, the tongue is generally red, without any fur; its cuticular covering seems to be removed in patches, and the appearance has been likened to raw beef.

Treatment.—Little can be done to remove this fever, without at the same time removing the cause. The perspiration may be checked by acids, and the diarrhœa restrained by astringents and opiates.

Exanthemata, Eruptive Fevers.

Scarlatina.

Scarlatina is described by Cullen and others as of three kinds, *simplex*, *anginosa*, and *maligna*.

The first is the mildest form of the disease; the second is attended with symptoms of sore throat; and the third assumes a typhoid or congestive character.

Symptoms.—In the commencement there are slight rigors, followed by pyrexia, with full and frequent pulse. On the second or third day an eruption shows itself upon the skin, commencing about the face and neck; it is diffused in broad patches, and nearly of the colour of a boiled lobster; it is generally very conspicuous about the bends of the arms and elbows, and if closely examined exhibits slight papular elevations, and occasionally small vesicles. The conjunctiva is red; the tongue furred, dry, and red at the edges,

and the papillæ are raised upon it. The eruption lasts a few days, and generally terminates in desquamation. In scarlatina anginosa, there is ulceration of the fauces and tonsils. There are very few cases in which the tonsils are not affected in some degree, and it often happens that the medical man is sent for in the early period of the disease to treat a sore throat, which he will know by experience is a prelude of the eruption.

Scarlatina is accompanied by inflammation of the mucous membranes, and is sometimes followed by anasarca.

Treatment.—In mild cases, simple antiphlogistics are all that is required. If inflammation of any part supervenes, general and local bloodletting may be had recourse to, and, in some cases, followed by a blister. The patient should be kept at a temperate heat, take cool drinks, and abstain from all stimulants. Laxatives are of great service, and great relief is sometimes experienced by sponging the body with tepid water. When gargles are necessary, warm water forms one of the best, and is of great use when its vapour is inhaled by the mouth.

The dropsy, which sometimes follows, generally requires bloodletting, in addition to purgatives and diuretics.

There are no distinct morbid appearances diagnostic of this disease. We find sometimes inflammatory appearances above the stomach and intestines, the lungs and bronchial lining; and inflammation and ulceration about the pharynx and fauces.

Morbilli or Rubeola, Measles.

Symptoms of the common inflammatory form: pyrexia, cough, hoarseness, dyspnœa, wheezing, sneezing, coryza, and drowsiness. On about the fourth day, an eruption of dingy red prominent spots, arranged in patches, with rather crescentic margins, show themselves about the face and neck, and gradually spread over the whole body; small red spots are also observed upon the palate. In three or four days more the eruption begins to disappear, and generally leaves desquamation of the cuticle.

This disease, which is always accompanied by some degree of inflammation of the pulmonary system, is liable to assume a congestive or typhoid form, and consequently becomes highly dangerous.

The varieties of measles are four, viz.:

Rubeola vulgaris.
..... *sine catarrho.*
..... *nigra.*
..... *putrida.*

The first is the form under consideration.

The rubeola *sine catarrho,* is a masked variety. The eruption has a more livid hue; there are less inflammatory symptoms, and there is generally little danger.

The rubeola *nigra* is more alarming, for it occurs in ill-fed, half-starved persons, and is attended with considerable congestion of the lungs, which impedes the free decarbonization of the blood.

Rubeola *putrida* is most dangerous, as it occurs

in weakly bodies, and prostrates the powers very rapidly, developing symptoms of a typhoid character; very few attacked by it escape.

Diagnosis.—Measles is distinguished from scarlatina by the colour of the eruption, the coryza, the spots are more elevated, and present crescentic margins, and are not arranged in patches of so large a size; the throat is likewise not so often attacked, and the tongue does not present the strawberry appearance so remarkable in scarlatina.

Treatment.—Keep the patient in a mild temperature; give diaphoretics, refrigerants, and saline purgatives. If the local symptoms run high, bleed generally and locally; if the chest be much oppressed, a blister may be applied after bloodletting, and ipecacuanha in small doses, will be found very useful.

If the patient be thin, or much depressed by the disease, great care will be required with the blister. It should only remain on long enough to redden the skin, and not to produce decided vesication as in other cases.

If the eruption leaves the surface, congestion and inflammation of the brain, pulmonary or abdominal viscera, may be apprehended; the eruption may sometimes be restored by having recourse to the warm bath, and stimulants rubbed upon the body.

Rubeola is very often followed by bronchial inflammation, and an inflammatory state of the mucous membrane of the bowels, producing diarrhœa.

In this diarrhœa, astringents and stimulants are improper. It is better to apply leeches to the anus or abdomen, followed by fomentations; to

use the warm bath, administer demulcents, and mild saline medicines, and give ipecacuanha in small repeated doses.

There are other sequelæ of this disease, and indeed also of scarlatina, such as enlargement and inflammation of the glands of the neck; in scarlatina, there is often inflammation of the parotid, which arises from the absorbent vessels of the tonsils communicating with those of the parotid gland. Dormant phthisis is likely to be hurried into action, and the mucous membrane may continue long in an unhealthy state.

The *morbid appearances* in case of death from this disease, are such as might be expected from the history and symptoms, viz.: pulmonary congestion, bronchial inflammation, with much fluid in the tubes; inflamed state of the mucous membrane of the bowels, with occasionally ulceration.

Roseola is a disease which is by some likened to measles; it is of a mild character, and is ordinarily of short duration. The varieties of it are detailed in works on cutaneous diseases. It may be distinguished from measles by more frequently attacking the lower extremities first, by the eruption being simultaneous with the fever, by the less degree of fever, and less constitutional disturbance.

For its cure it requires mild purgatives and antiphlogistics.

Variola, Small-pox.

Symptoms. — This disease commences with rigors, and pain referred to the back and epigastrium; there is uneasiness at the stomach, with

retching and vomiting; the eyes are redder than natural; the tongue is covered with a white fur; there is a hot skin and quick pulse; convulsions in this stage are very common in children, especially when the disease is likely to be severe and confluent. On the third day an eruption shows itself, and gradually spreads over the whole body. About the fifth day, vesicles form in each spot; in a day or two the vesicles lose their elevation, and a puriform fluid is effused in each. They are surrounded by a red areola, and there is great tumefaction of all the parts affected, especially the face. About the ninth day the pustules are completely formed, and, in two or three days, begin to break and dry up. Thus the eruption may be said to have three stages, *papular*, *vesicular*, and *pustular*.

The eruption, in severe cases, is followed by pitting, resulting from a loss of substance in the rete mucosum and cutis vera. A slough is said to have been thrown off in each of such spots.

Secondary fever sometimes comes on, and is generally occasioned by an overloaded state of the bowels, and the cessation of the cutaneous discharge.

There are two forms of small-pox commonly described, the *distinct* and *confluent:* in the first the pustules are separated, in the latter they run one into the other.

Diagnosis.—This disease can only be mistaken for varicella, from which it is distinguished by the pustules presenting the central depression; by being of longer duration; and the areola being more red, larger, and more raised.

The *sequelæ* of this disease are inflammation of

the conjunctiva, ophthalmia tarsi, which is very tedious and troublesome; swelling and inflammation of the glands of the neck, bronchial affection, and disease of the lungs stirring up phthisis in scrofulous subjects, and abscesses forming in various parts of the body.

Post mortem appearances.—Turgidity of the vessels of pia mater, with an opacity of the arachnoid and fluid in the ventricles, pustules on the tongue, ulcers in the throat, inflamed state of the bronchial tubes, which contains much fluid, and an inflammatory state of the mucous membrane of the alimentary canal.

Treatment.—The treatment is the same as for fevers in general: in some cases general and local bloodletting are necessary, and the room should be cool and ventilated. To prevent the marks which usually follow, it is recommended to open the pustules on the face early, with the point of a lancet, to keep the patient in a dark room, to apply cold lotions to the face, and lastly, to touch the surface of each pustule with a solution of nitrate of silver.

Varicella, Chicken-pox.

Symptoms.—Pyrexia, with an eruption of small red protuberances, or vesicles without depression. The fluid in the vesicle becomes white, and, about the third day, straw-coloured; on the fifth and sixth day, the disease begins to subside very fast.

Diagnosis.—It is distinguished from small-pox by the slight fever; the vesicles contain serum on the first day of the eruption; the areola is not

so red, and raised; and the vesicles do not present the central depression. No suppuration takes place, and the eruption scarcely remains entire on the fifth day; the vesicles come out irregularly, some showing themselves after others have gone through their stages.

Treatment.—Gentle laxatives, refrigerants, and diaphoretics, proportionate to the symptoms, may be given.

Miliaria, Miliary Fever.

Symptoms.—There is pyrexia, great languor and depression of spirits, laborious respiration, heat of the body, and a tingling sensation is felt over the skin; there is profuse sweat, of a sour, unpleasant smell. Pimples, about the size of millet-seeds, appear about the body, filled with a whitish, serous fluid. In two or three days the vesicles break, and desquamation follows. It is said to be most common in women after lying in, and is supposed to be induced by the excessive heat to which their bodies are exposed by an enormous quantity of clothing.

Diagnostic character.—The profuse unpleasant perspiration, and peculiar eruption.

Treatment.—Give saline purgatives, admit cool air, and allow only light clothing; it is seldom that more than the mildest measures are necessary.

DISEASES CONNECTED WITH THE DIGESTIVE SYSTEM.

Aphthæ.

Symptoms.—In this disease there are small, pearl-coloured, white vesicles on the tongue, lips, and inner surface of the mouth and throat, proceeding to superficial ulceration, and terminating in exfoliation of the cuticle. In some cases it extends along the entire alimentary canal, producing diarrhœa. The anus appears very often inflamed, and, in females, the vagina. There is almost always some febrile excitement, and there is generally drowsiness as a precursory symptom. This disease is almost confined to infancy, but a similar state occurs in adults and old people, in protracted and dangerous diseases, and is very often a premonitory sign of death.

Treatment.—An emetic may be given, and followed by gentle purgatives. Emollient enemas, containing a few drops of laudanum, occasionally give great relief; where there is much depression, aromatic powder and wine, in small doses, become necessary. Some practitioners apply stimulant embrocations to the abdomen, and rub the mouth with a mixture of borax and honey. The medicine which acts most favorably and safely is rhubarb with magnesia, and a little carbonate of soda. This treatment is applied to the aphthæ of infants.

Cynanche Tonsillaris, Inflammatory Sore Throat.

Symptoms.—Pyrexia; redness and swelling of the tonsils and fauces, sometimes extending to the Eustachian tubes, producing deafness, and affecting the uvula, causing an elongation of it; thus giving rise to an incessant desire to swallow. The deglutition is impeded; the voice is indistinct; and there is dyspnœa and headach; the tongue is much coated; and the fauces occasionally become covered with white specks, which terminate in sloughs. This disease is prone to terminate in ulceration or suppuration.

It is generally brought on by wet and cold, particularly when the digestive functions are disordered.

Treatment.—Bloodletting from the arm is sometimes necessary. Leeches and blisters may be applied externally. An emetic is sometimes useful, but brisk purgatives are requisite in nearly all cases. The vapour of vinegar and water may be inhaled. Scarifying the tonsils early gives great relief.

Cynanche Maligna, Putrid Sore Throat.

Cynanche tonsillaris sometimes assumes a typhoid character, resembling the state of throat which occurs in scarlatina maligna.

Symptoms.—Shivering, anxiety, and great restlessness. The fauces are tumid, and of a deep

red colour, interspersed with white specks, which are also found in the mouth. The pulse is quick but weak, and sometimes irregular; there is pain in the throat; the voice is indistinct, and deglutition very painful; the tongue dry, and covered with a dark thick fur; diarrhœa, and great prostration of strength; a papular eruption sometimes breaks out about the neck, of a fiery-red colour, and gradually extends to other parts of the body. The ulceration increases, and extends to the alimentary canal or trachea; gangrene supervenes, and death follows.

Treatment.—At the commencement of the attack, leeches may be applied to the throat, and be followed by a blister; an emetic also has been found serviceable; but, as soon as an evident depression of the system takes place, the strength must be supported by stimulants and aromatics, as wine and bark, with cinnamon, and the like. The room should be well ventilated, and all effluvia removed; light nourishment should be administered, and the throat may be gargled with stimulant and astringent gargles, and by such as are considered disinfecting, viz., diluted hydrochloric acid, and chloride of soda. The disease generally arrives at a crisis about the fifth or seventh day.

Cynanche Pharyngea, Inflammation of the Pharynx.

This disease occupies the parts posterior to the soft palate, which are generally observed very red, and covered with a thick viscid secretion. There is an incessant desire to be spitting or swallowing.

Deglutition is exceedingly painful. The treatment is the same as for cynanche tonsillaris, but particular attention must be paid to the bowels.

Dyspepsia, Indigestion.

Symptoms.—The symptoms of this disease are of so varied a nature, that it is difficult to describe concisely the order in which they occur. There is generally loss of appetite; nausea; headach; depression of spirits; acrid eructations; heartburn, costiveness, or diarrhœa; a small slow pulse; a white furred tongue, and disturbed sleep. The fæces are either very dark, or of a clay colour, and very fœtid.

Treatment.—The remedies most efficacious are gentle purgatives, such as rhubarb, with small doses of mercury; bitter tonics, such as gentian, cascarilla, and small doses of the aloetic preparations, combined with alkalies, to correct the acidity. The diet should be light and nutritious, and not sufficient to completely satisfy the appetite. Much may be done by gentle exercise, and by attending to the habits and state of mind of the patient.

It is often produced by an abuse of stimulating liquors, and then may be considered to be a subacute inflammatory state of the lining coat of the stomach. In such cases, leeches over the stomach, and hydrocyanic acid with antiphlogistic remedies generally act best.

Connected with dyspepsia, there are some symptoms which have names, as if they were separate diseases, such as pyrosis, heartburn, and gastrodynia.

Pyrosis, also named *water-brash*, is characterized by the throwing off, or bringing up from the stomach, a large quantity of watery fluid, very much to the annoyance and inconvenience of the patient: one of the best remedies for it is the trisnitrate of bismuth.

Heartburn is a sensation of heat at the stomach with acrid eructations, and a feeling of heat and irritation in the fauces. It is often experienced by those who commit excesses in drink: the best remedies are calcined magnesia, carbonate of soda, and mild purgatives.

Gastrodynia, or *gastralgia*, is a painful state of the stomach, supposed to be neuralgic. The pain extends to the back, causes anxiety and faintness; is attended with headach, flatulence, often constipation, and sometimes eructations of thin fluid as in pyrosis. There is no single remedy very certain in its operation; the chief thing is to avoid indigestible substances. Some medicines which contain anodyne qualities will relieve, such as lactucarium and hydrocyanic acid; and assistance may be given by stimulating embrocations over the stomach.

Hæmorrhois. Hæmorrhoidal Flux—Piles.

Symptoms.—Severe pain and inflammation at the anus, with discharges of blood with the motions; frequently protrusion of part of the mucous membrane of the rectum containing hæmorrhoidal veins: greatest relief in the recumbent posture.

Piles are spoken of as blind and bleeding, and

the term may be said to apply to four different states, viz.:

Varicose state of hæmorrhoidal veins, with some thickening of the mucous membrane.

A similar state, extending to effusion of blood in the submucous tissue, which may be thickened and form condylomatous projections.

A fungoid state of the mucous membrane, exhibiting a variety of appearances.

A prolapsed condition of the mucous membrane, which becomes indurated, and forms a ring round the anus, and is almost strangulated by the sphincter ani.

The disease is dependent upon inattention to the bowels, habitual costiveness, torpor of the liver, pulmonary disease, and is very common in pregnancy; frequent with persons who sit much, and with the body bent forward.

Treatment.—In the inflammatory stage, apply leeches and fomentations, and afterwards cold lotions, the recumbent posture being resorted to; give mild purgatives, and keep the bowels in rather a loose state. Unguentum gallæ and other astringents are beneficial, and great service is done by clearing out the rectum and colon by the enema syringe every morning, with warm water at first, afterwards reduced down to cold. If hæmorrhage proceeds from vessels higher up, the confectio piperis nigri will be beneficial.

Hæmatemesis, Vomiting of Blood.

Symptoms.—Clotted blood is vomited up of a dark colour, and this comes on rather suddenly. It is often preceded by a sensation of weight and pain at the stomach. On examination, it is seldom that any large vessel is found ruptured.

The blood is generally poured out by the exhalant extremities of the arteries.

This disease may be mistaken for hæmoptysis, from which it is distinguished by the blood being brought up by vomiting, being more clotted, and of a less florid colour, and not attended with cough, and generally mixed with some undigested food. It is often occasioned by an obstructed circulation of blood through the branches of the vena portæ, consequently the vessels which propel their contents into that vein being overloaded, give rise to the effusion into the stomach. It may also proceed from disease of the spleen, or from ulceration of some parts of the stomach. It is more common in women, and they suffer from it frequently, when the menses cease; or during the menstrual period of life, if the proper discharge be checked; washerwomen are said to be frequent subjects of it.

Treatment. — In plethoric habits bloodletting is necessary; acids and astringents, in a cool state, may be given, and followed by purgatives. Acetate of lead is sometimes very efficacious; oleum terebinthinæ, in small doses, arrests the hæmorrhage in a wonderful manner. Those who consider the disease to be connected with disorder of the liver, bleed, give calomel largely and repeatedly, and administer purgatives.

Colica, Colic.

Symptoms.—Violent pain in the abdomen, with a twisting sensation about the umbilicus; there is spasmodic contraction of the abdominal muscles;

constipation, and sometimes vomiting, with hiccup and flatulent eructation. Colic is distinguished from enteritis and peritonitis by the pain being diminished upon pressure, by the pulse being in a very slight degree affected, and by the absence of much constitutional disturbance.

Another form of colic attacks painters and others who work in lead, and is named *Colica Pictonum.* In this disease the pain is more constant, and not so diffused, although quite as violent. Constipation is a constant symptom; there is a peculiar appearance in the colour of the countenance, and there is often paralysis of the upper or lower extremities.

Treatment.—In common colic, an enema of tobacco or turpentine, opiates, and castor oil, with aromatics, may be administered, and hot fomentations may be applied to the abdomen.

In colica pictonum, bloodletting is frequently necessary, in consequence of inflammation of the mucous membrane of the intestines, which frequently supervenes. The medicines most useful are calomel and opium, castor and croton oils, and turpentine, taken by the mouth, and used as an enema. Cupping over the abdomen is sometimes useful, as well as warm fomentations. Alum also, in large doses, is said to do good, and has been used successfully by many eminent practitioners.

Morbid appearances.—Simple colic never kills, but is presumed to depend upon a morbid spasmodic contraction of the muscular fibres of the intestinal canal. In the colica pictonum many have died: a considerable part of the bowels has been found highly inflamed and ulcerated, with a

thickened mucous membrane, and sometimes inflamed patches in the peritoneum.

Ileus.

Symptoms.—Severe pain in the bowels, like colic, with fœtid eructations, rapid pulse; then vomiting of offensive fæcal matter ensues: there is obstinate constipation, and more or less fever; it is often fatal in a few days.

Morbid appearances.—Dilatation of a portion of the bowels, with the part below it contracted and highly inflamed. There is often peritonitis over the part, effusion of lymph, and sometimes gangrene: occasionally there are scirrhous tumours or intussusception.

Treatment.—The chief object is to procure a free passage through the bowels, which is generally impracticable. Various purgatives may be tried, and enemata be introduced; sometimes opium, in large doses, has aided the operation of other remedies.

Intussusception, or the invagination of one part of the bowels in another, is a disease most frequent in children. During life it may be suspected, but not known for certainty; it is most frequent at the junction of the ilium and cæcum. The symptoms resemble those of ileus; but, in addition, there is a desire to go to stool, without any other evacuation than some mucus tinged with blood. It is sometimes fatal in thirty-six hours. On examination after death, the mucous membrane of the invaginated part is found highly inflamed. No medical treatment has been attended with much success, but the same treatment

may be pursued as in ileus. Some mechanical practitioners have recommended in this and in ileus the taking of large quantities of metallic mercury, under the idea that it may force a passage: there is no objection to the experiment.

Vermes, Intestinal Worms.

The worms which infest the human intestines are principally of three kinds: the *tænia, lumbricus teres,* and *ascaris.*

The *tænia* is found in the small and large intestines, seldom in children. There are two species of this worm, the *tænia solium* and the *tænia vulgaris.*

The tænia solium, as its name implies, occurs singly, and has long joints. The tænia vulgaris occurs in numbers, not of so great a length as the other: its joints or pieces are shorter, and, relatively to their length, broader; so that this worm is also named tænia lata.

The *lumbricus teres* is found in the small intestines and stomach. It somewhat resembles the earthworm, and is occasionally brought up by vomiting.

The *ascaris,* or *oxyuris* is found chiefly in the rectum, and is principally troublesome to children.

Symptoms produced by worms. — In children, one of the first circumstances which leads to a suspicion of their existence is picking at the nose; the face is pallid; there is emaciation of the body, and swelling of the abdomen; a furred tongue, impaired appetite, peevishness, and want of sleep; occasionally there is great pain in the

abdomen, with purging, and epileptic fits or convulsions.

Treatment. — Anthelmintics act either by mechanically dislodging the worms, or by exerting some poisonous influence upon them. The best for ascarides, are calomel with scammony or jalap, cowhage, and injections into the rectum of turpentine or decoction of aloes. For the lumbricus and tænia, the best remedy is spiritus terebinthinæ; and, if that should not be used, the male fern-root, the root of the pomegranate, or spigelia marilandica, may be tried.

At the time that the above remedies are used the vegetable tonics should be given, as the existence of worms very generally depends upon a weakened state of the digestive functions. The best mineral tonic to prevent the reproduction of them is the tinctura ferri sesquichloridi.

The diet should be nourishing, and green acid vegetables should be avoided; salt should be freely used with the food, for total deprivation of it is almost certain to be followed by the production of worms, especially in ill-fed persons.

Peritonitis, Inflammation of the Peritoneum.

Symptoms.—Pyrexia; great heat and pain in the abdomen, at first confined to a small spot, but subsequently diffused over the whole surface, which is tense, and so painfully tender that the weight of the bedclothes is unsupportable; the knees are drawn up to take off the tension. The pulse is an uncertain symptom; sometimes it is quick, full, and hard; at other times, slow, soft, and contracted; but its general character is that

of being hard, corded, and incompressible. The tongue is at first white, afterwards brown, and red at the edges. There is generally constipation. The respiration is quick, difficult, and thoracic; but there is seldom much vomiting, unless the peritoneal covering of the stomach be attacked.

Causes.—It is generally brought on by cold, by habitual costiveness, contusions, and wounds produced by accident or surgical operations, as in hernia, &c.

This disease might be mistaken for enteritis, hepatitis, and splenitis.

Treatment.—The principal part of the treatment consists in bloodletting from the arm, and locally by leeches, which are to be repeated after short intervals, if the disease does not yield. Subsequently gentle laxatives may be given, and soothing enemas be administered. After bleeding, most practitioners rely upon repeated doses of calomel and opium. When the bowels become tympanitic, an enema, containing turpentine, may be thrown up. The regimen must be completely antiphlogistic. Late in the disease, blisters over the abdomen may be applied.

Morbid appearances.—The small vessels of the peritoneum minutely injected with blood, shreds of lymph covering many parts, and the intestines almost agglutinated together by it; serum in the cavity, with flocculi of lymph in it, and sometimes a considerable quantity of pus. The fluid will be found gravitating towards the pelvic cavity.

A form of peritonitis attacks females after parturition, and is called *puerperal peritonitis.* It differs from the other, inasmuch as it occurs in

patients who have for months past been debilitated by the progress of utero-gestation, and more recently by the enfeebling efforts of parturition. It often attacks debilitated constitutions; and, from assuming a masked character, has been generally more fatal than common peritonitis.

The seat of disease is essentially the same: it comes on about the third day, being preceded by alteration or suppression of the lochial discharge, flabby breasts, and acute pain in the hypogastric region: the pain and inflammation soon extend over a considerable portion of the peritoneum.

Treatment.—Bloodletting and calomel are to be mainly depended on in this form of disease. When it is coexistent with congestion or typhoid symptoms, large doses of turpentine are found exceedingly useful.

The morbid appearances are the same as in ordinary peritonitis, excepting that the broad ligaments exhibit traces of high inflammation.

Puerperal fever is a very dangerous disease, and is generally described under the head of peritonitis. By some observing practitioners, a clear distinction has been drawn between it and peritonitis, such as I will copy from Dr. Waller's excellent little work on midwifery.

	Peritonitis.	*Puerperal Fever.*
Pulse,	small and hard, or full and round; seldom exceeding 100, at the onset.	soft and undulating, from 140 to 150, soon after the chill.
Head,	not much affected.	suffers severe pain, sometimes great confusion.
Tongue,	dry and white.	at first natural, afterwards glassy or dark brown.

	Peritonitis.	*Puerperal Fever.*
Secretions,	checked, or entirely suspended.	at first natural, afterwards altering in quantity and quality.
Pain,	superficial.	at first deep-seated and decidedly uterine.
Skin,	hot and dry.	variable, not unfrequently moist and perspiring.

Treatment.—The management of this disease is very difficult, and the recoveries few. Dr. Waller recommends leeches to be applied over the hypogastric region, to be followed by fomentations, and afterwards spirits of turpentine, to produce counter-irritation: internally, opium in large doses, with some calomel; and afterwards, the same medicines in smaller quantities, some mild laxative for the bowels, and, if diarrhœa comes on, the use of chalk mixture, with aromatic confection, and confection of opium.

Post mortem examination exhibits inflammation of the peritoneal covering of the uterus and its appendages, enlargement of the uterus, and, on cutting in it, inflammatory state of the uterine veins, which often contain some pus.

Gastritis, Inflammation of the Coats of the Stomach.

Symptoms.—Pyrexia; thirst, with great desire for cold drinks; great heat and dryness of the skin; pain at the epigastrium, increased upon pressure; retching and vomiting of nearly every thing taken into the stomach; the pulse is quick, but small and compressible; there is great prostration of strength; frequent hiccup; and the

tongue is generally much furred in the centre, with red tip and margins.

Diagnostic character. — The excessive vomiting, the seat of pain, and great heat of the epigastrium.

Treatment. — The best remedial means are, copious bloodletting, by venesection, and leeches applied to the epigastrium; fomentations, the warm bath, enemas, and, after copious bloodletting, laxatives, demulcents, and diaphoretics; opium may also be given in small doses combined with calomel.

Some pathologists consider the disease to be seated in the muscular coat, others affirm that it always commences in the peritoneum; and as few deaths occur from such a disease, limited to the stomach, it will be very difficult to decide upon the question.

Enteritis, Inflammation of the Peritoneal Coat of the Intestines.

Symptoms.—Pyrexia; pain in the abdomen, increased upon pressure, but not so acute as in peritonitis. There is frequently some tension; a weak, contracted, and compressible pulse; great depression and loss of strength; high coloured urine. The tongue is furred, and generally very red at its tip and margins. The pain varies in situation, according to the part affected; if the upper portion of the small intestines is attacked, there will be vomiting, and pain about the umbilicus: if the colon is suffering, there is pain extending along its course, called tormina, and there will often be diarrhœa: when the rectum is

the part affected, there is often bearing down, with tenesmus, and evacuation of bloody mucus.

Treatment.—Bloodletting, enemas, &c. may be resorted to, as in peritonitis, and the general treatment will be much the same. Blisters are not very often necessary; but stimulating embrocations over the abdomen may be susbtituted for them. Laxatives of the mildest kind only are admissible.

Enteritis Mucosa.

This term is applied to an inflammatory state of the mucous coat of the small intestines. The symptoms are variable, but the most prominent are the following, and it may be considered more a symptomatic than idiopathic affection.

Symptoms.—Tenderness of the abdomen increased upon pressure; quick pulse; febrile heat; thirst; considerable debility; the tongue red and smooth; and the lips often inflamed and sore; sometimes an aphthous state of the mouth; there is generally diarrhœa; the stools contain much mucus; some blood, and there is frequently tenesmus.

Treatment.—If the disease be apparently idiopathic, blood may be drawn from the arm, and leeches may be applied over the abdomen. The warm bath and fomentations are useful. The medicines may consist of hydrargyrum cum cretâ, as an alterative, every night; cooling draughts, with a little hydrocyanic acid; copious bland demulcents, and enemata of starch with some opium to relieve the tenesmus, which is often troublesome. Occasional doses of castor oil or rhubarb may be given to carry off any accumulating

portion of hardened fæces. To check excessive purging, decoction of logwood is a mild remedy.

Morbid appearances.—In fatal cases there is inflammatory redness of the mucous membrane, patches of inflammation, with elevation; sometimes ulceration, softening, and removal of the mucous coat, and in some cases perforation. Gangrene has been seen in a few instances.

Diarrhœa, Looseness.

Symptoms.—Frequent discharges of liquid fæcal motions, with pain and griping; considerable weakness and prostration.

Diarrhœa may depend upon irritation or inflammation of the mucous membrane of the bowels; produced by indigestible food, accumulation of fæces, vitiated biliary secretions, cold, &c. When it depends on any acute inflammation, it may be known by other constitutional symptoms.

Treatment.—The treatment must vary with its causes. If diarrhœa arises from cold, a warm bath is indicated; if it depends upon imflammation of the intestines, bloodletting and leeches will be necessary; if from vitiated bile, accompanied by vomiting, calomel and rhubarb will be useful, followed by small doses of opium; if it is occasioned by acrid indigestible food, the bowels should be relieved by castor-oil, followed by mild astringents and tonics.

As a general rule, the best plan is to give a good dose of calomel and rhubarb, follow that up by a dose of castor-oil; and generally when the bowels have been cleared out, the disease ceases com-

pletely; if not, give the chalk mixture, or compound chalk powder, or any of the ordinary routine astringent medicines.

Dysenteria, Dysentery.

Symptoms.—Pyrexia; flatulence; nausea or vomiting; griping of the bowels; frequent inclination to go to stool; tenesmus; frequent evacuations from the rectum of mucus mixed with fæces or blood; sometimes films, like membranes or fat, are passed, with portions of indurated fæces; there is great debility.

Treatment.—The remedies to be employed are venesection and leeches, the warm bath, demulcent drinks, antimonials, ipecacuanha; and if there be any suspicion of fæcal matter in the intestines, castor-oil, or rhubarb, with opium may be given. Counter-irritants may be applied to the abdomen, and a suppository of opium, or starch enemas with opium may be introduced into the rectum.

The disease is principally seated in the colon, and in the rectum.

The *morbid appearances* are an inflamed state of the colon and rectum; the peritoneal covering is sometimes affected; the mucous coat is thickened, raised in parts, as if hypertrophied, round a central depression, resembling an ulcer; sometimes there are ulcerations and perforations of the intestines, which admit the passage of fæcal matter into the peritoneal cavity; and in some cases gangrene.

A chronic form of the disease is met with here,

especially in persons who have returned from hot climates. The repeated purgings, with discharges of mucus, even pus and blood, gradually wear down the system, and the sufferers ordinarily present a pale, emaciated, sickly appearance. They are most benefited by light food, the use of laxatives, to keep the motions soft, and the bowels free; by taking mineral tonics, such as sulphate of copper or zinc; alterative mild doses of mercurials may be given; and I have seen considerable relief from the administration of iodide of potassium combined with the extract and powder of conium.

The disease is unfortunately but seldom cured.

Cholera Morbus.

Symptoms.—A sensation of heat at the scrobiculus cordis; vomiting and purging of bilious matter; hurried respiration; great depression and anxiety; griping pains in the abdomen; a quick, but small and contracted pulse; excessive thirst; spasmodic contraction of the muscles of the abdomen and extremities. The surface is pale, and exceedingly cold; and the blood, when drawn, is very dark and thick, approaching to a pitchy consistence. There is also suppression of urine.

The *morbid appearances* found on dissection are generally those of congestion of the different viscera. The stomach and intestines are sometimes of a scarlet colour, and there is a copious secretion of thick mucus within them. The urinary bladder is found nearly always contracted.

Treatment.—The means to be used in this disease are pretty generally agreed upon. At the commencement, blood should be drawn from the

arm, and heat be applied to the surface, to restore the balance of the circulation. Strong stimulants are to be given, (as the disease is not one of simple inflammation,) and followed by repeated doses of calomel and opium. When the early danger has subsided, light nourishment should be administered, and care taken that reaction does not bring on visceral inflammation.

The *Asiatic* or *Spasmodic Cholera*, is distinguished by the absence of bile in the evacuations from the stomach and bowels. The ejected fluids resemble rice-water. There is almost invariably a purple or blue appearance of the extremities, and a very characteristic expression of countenance, and painful spasms in the extremities and abdominal muscles. The most successful plan of treatment has been that in which the chief reliance is placed on calomel. Salt-water emetics have been highly commended in the very worst forms of the disease. A very favorable symptom in the course of the disease is the appearance of bile in the evacuations.

Hepatitis, Inflammation of the Liver.

Inflammation of the liver is generally seated in and near the peritoneal covering, rarely attacking the substance itself.

Symptoms of acute hepatitis.—Pyrexia; pain felt in the right hypochondrium, increased upon pressure; tongue covered with a yellowish fur; difficult respiration; dry cough; pain is felt in the right shoulder; the urine is high coloured; the pulse is quick and hard. There is gastric irritability and hiccup; if the inflammation be very

acute, the secretion of bile is suspended, and the fæces assume a clay colour. The skin also assumes a yellow tinge, and there is a difficulty in lying on the left side, arising from distension of the ligaments and peritoneal covering.

Morbid appearances.—Lymph on the surface of the liver, causing adhesions with the neighbouring parts; enlargement, less firmness; it breaks easily with pressure, and generally is very much gorged with blood; sometimes reduced almost to a pulpy state; occasionally there is a large abscess. This abscess of the liver may burst during life, and the patient may recover. The part which allows its escape, and is most favorable, is the abdominal parietes, anteriorly; it finds its way also into the lungs, through the diaphragm, and into several parts of the intestinal canal: when it bursts into the peritoneal cavity it kills very rapidly, or will set up very extensive peritoneal inflammation, which destroys in a few days.

In *chronic hepatitis*, there is a feeling of weight and dragging sensation at the liver, with sometimes a hardness perceptible externally; pain in the shoulder; dyspepsia; sallow countenance; attacks of jaundice; nausea; low spirits; costiveness, and general derangement of the whole system. The pulse is no guide, for it is often weak and slow; sometimes quickened, with short attacks of fever. There is in many cases an eruption about the face and shoulders, much of the nature of acne.

Morbid appearances in chronic hepatitis.—These are very variable; we find induration either with enlargement or contraction; granular appearance, either increased or diminished, with

an unhealthy disproportion between the red and yellow parts, producing various shades of nutmeg liver, such as is often to be found in drunkards. Parts are seen of a firm texture, and of yellow colour, scattered through the liver, with vessels shooting into them, and raising up the surface of the liver, giving it a lobulated appearance, and this surface often of a green colour. The reader will find several illustrations of diseased appearances of the liver in Dr. Hope's excellent work on morbid anatomy.

Treatment.—Take blood away from the arm freely, and apply leeches to the seat of pain. Counter-irritants may be applied. Gentle laxatives and enemas should be administered, and recourse be had to the warm bath. Some practitioners give calomel in large doses, but not so much as formerly, for it appears to be more useful in the chronic form of the disease.

There are many other morbid states of the liver less definite in their symptoms, and scarcely curable, which are described in larger works, such as scirrhus, tubercles, fatty liver, hydatids, &c.

Chronic hepatitis is most relieved by calomel, chalybeate waters, mild purgatives and tonics: iodide of potassium too is an excellent auxiliary.

Icterus, Jaundice.

Jaundice arises from some obstruction to the course of the bile, either depending upon inflammation or mechanical pressure upon the minute ducts, or the large duct itself. The causes are generally acute and chronic disease of the liver, increasing or diminishing the flow of the bile;

duodenitis; gall-stones obstructing the duct; inflammation, contraction, or spasm of the duct, and mechanical pressure, as during pregnancy, &c.

Symptoms.—Yellowness of the skin, affecting the conjunctiva, and sometimes causing objects to be seen of a greenish colour, sometimes preceded by tingling of the skin. There is often pain in the right hypochondrium; nausea and vomiting; great lassitude and languor; the fæces are white, and the urine high coloured, generally giving a yellow tinge to the linen. The pulse is rather slower than usual, unless there be hepatic inflammation.

Treatment.—When there is pain in the hypochondrium, leeches should be applied. Emetics are sometimes useful, and may be followed by mild mercurials, laxatives, and the warm bath. The diet should be of the lightest kind.

Gall-Stones.

Gall-stones sometimes attain a considerable size; escape from the gall-bladder, and try to make their way into the duodenum, and in their passage cause much distress.

Symptoms.—Acute lancinating pain in the situation of the gall-ducts, coming on in paroxysms; not much pain externally; the pulse little affected; and not much constitutional disturbance; inflammation is liable to arise, therefore the treatment has to be directed to it.

Treatment.—Give opium in large doses, use the warm bath, bleed from the arm, and try the effect of a relaxing emetic. Some recommend ether,

both as an antispasmodic, and under an impression that it may act chemically upon the gall-stones; sometimes leeches or cupping-glasses over the liver afford relief.

Splenitis, Inflammation of the Spleen.

Symptoms.—Pyrexia; pain in the left hypochondrium, increased upon pressure; difficulty of lying on the affected side; a yellowish tinge of the skin. In chronic splenitis, and frequently in intermittent fever, the spleen is found greatly enlarged, and when examined after death, presents a soft, black, pulpy appearance, like decomposing blood. The spleen is also liable to become tuberculated both on its surface and within its substance.

Treatment.—Bloodletting, generally and locally; purgatives, warm bath, and counter-irritants, are the remedies to be employed.

In chronic enlargement of the spleen, mercury is used, both internally and externally. Bromide and iodide of potassium are reported to be valuable remedies for its removal.

DISEASES OF THE RESPIRATORY ORGANS.

Catarrhus, Catarrh.

Symptoms.—Sneezing, with increased secretion of mucus from the nose and fauces; pyrexia; cough; pain in the head and chest. Sometimes the inflammation extends down the larynx and trachea, giving rise to copious expectoration.

The fluid expectorated generally becomes thicker as the disease declines.

Under the name catarrh, bronchitis of the subacute kind is often described.

Treatment.—Confinement to a warm room, antiphlogistics, the warm bath, and diaphoretics, such as antimonials and ipecacuanha, and brisk purgatives are to be employed. Bloodletting is seldom necessary.

Bronchitis.

This disease has obtained several names from the different authors who have treated upon it It is called *peripneumonia notha, catarrhus suffocativus;* and, when in the chronic form, in old people, *catarrhus senilis.*

Symptoms of acute bronchitis.—Pyrexia; heat of the skin; dyspnœa, with hurried and laborious respiration; feeling of roughness or rawness in the trachea; hoarseness; oppression at the præcordia; and dry cough. After a short time there is an accumulation of mucus, giving rise to a wheezing or rattling noise in respiration, known as the râle muqueux. There is a leaden colour of the lips and cheeks, caused by the blood not being properly decarbonized. The pulse is quick, but soft and compressible; there is great prostration of strength, and anxiety; pain and giddiness of the head; sometimes delirium.

Stethoscopic signs.—At first, sibilous or sonorous rhonchus; when secretion takes place, the mucous rhonchus; sometimes the mucus plugs up a bronchus, and for a time, the respiratory murmur is lost in the part of the lung which the bronchus

supplies; but there is no dulness of sound on percussion, which will distinguish this state from hepatization.

Morbid appearances.—The lungs gorged with blood, sometimes emphysematous on their surface; the bronchial tubes, filled with thick reddish mucus, and often with a fluid of a muco-purulent character; the membrane is highly inflamed; and the same appearances may extend into the trachea. We also find the vessels of the head, liver, &c. congested.

In *chronic bronchitis* the expectorated fluid resembles that emitted during the latter stages of the acute form, sometimes it has a purulent appearance, and is often mixed with blood: there are sometimes nightsweats, with emaciation: hurried and short respiration.

Treatment.—Bloodletting, with caution, is necessary; it is very beneficial at the commencement; but, when much fluid has been effused into the bronchi, the strength should not be too much lowered, for fear that there will not be sufficient power in the system to throw off what has been accumulated. The best medicines are emetics and antimonials; counter-irritation should be produced by a blister or tartar-emetic ointment, and purgatives may be given when required.

Laryngitis, Inflammation of the Larynx.

Symptoms.—Pyrexia; a sensation of constriction and pain about the larynx; hoarseness; respiration quick and laborious; anxious expression of the countenance; pulse quick and small, and a peculiar shrill noise attends inspiration.

This inflammation frequently accompanies small-pox, scarlet fever, and measles.

Morbid appearances.—The mucous membrane thick and vascular, with numerous small ulcers, rendering its surface irregular; sometimes covered over with a layer of tenacious lymph.

Treatment.—The same as for croup.

Cynanche Trachealis, Croup.

Symptoms.—It generally commences with symptoms of common cold, as hoarseness, which may last almost unnoticed for a few days, till the patient gets gradually worse; the symptoms then become aggravated, often at midnight, when we have them of the following character: pyrexia; difficulty in breathing, attended with a peculiar crowing sound; great anxiety; the face and neck are flushed, but rather livid in appearance; the voice almost inaudible; there is cough, at first rough and dry, subsequently more free, and a viscid glairy matter is expectorated with great pain. This disease generally attacks children between the second and fifth year of their age. When fatal, it terminates mostly about the third or fourth day. The principal cause of death is the formation of a false membrane, which occupies the trachea, and sometimes extends to the larynx and bronchi.

Morbid appearances.—We find lymph in the trachea, constituting a false membrane in different degrees; sometimes soft, and yielding, partial or extending the whole length, and even into the bronchi; sometimes it is exceedingly thick, and assumes the form of a perfect tube. The larynx

often contains lymph; and the ramifications of the bronchi, and even the lungs, present an inflammatory appearance; the inflammation may extend to the pharynx and œsophagus.

Treatment.—Bloodletting, from a vein, is absolutely necessary at the commencement; leeches are to be applied along the course of the trachea, and upon the sternum. An antimonial emetic should be given, and followed by nauseants, purgatives, and warm bath. In some cases a blister is useful after leeching. Calomel, in large repeated doses, such as two or three grains every hour, is relied upon by some persons. Dr. Cheyne gives a preference to tartarized antimony.

Some other modifications and varieties of croup are mentioned by authors, such as spasmodic croup, œdema glottidis, and the crowing disease.

Spasmodic croup occurs in young children during dentition. It is not purely spasmodic, for it is frequently connected with congestion and inflammation of the mucous membrane of the larynx. It is much milder and less dangerous than real croup, and is often relieved by an emetic, and some purgative medicine. It comes on mostly in the night. The other remedies for it are, the warm bath, lancing the gums, and the application of two or three leeches to the chest.

Œdema glottidis is rather a symptom of inflammation of the surrounding parts. The epiglottis and adjoining membrane become swollen, both from congestion of the vessels and from serous infiltration into its cellular tissue. It is not very easy to decide upon it with certainty. The usual active antiphlogistic measures are to be pursued; tracheotomy may be performed, with the greatest

advantage; and some have applied to the epiglottis concentrated acids, or a strong solution of nitrate of silver, with success.

The *crowing disease* of children is a modification of croup, but with much less violent degree of inflammation: besides, it is much connected with the cerebral functions, and condition of the alimentary canal. The treatment is as follows: a leech or two may be applied to the chest, the bowels attended to, some calomel may be given daily; the surface of the body should be protected, the gums lanced; and sometimes a leech or two, or counter-irritants, may be applied to the head.

Pertussis, Hooping-cough.

Symptoms. — A peculiar convulsive cough, coming on in paroxysms, consisting of several hurried expirations followed by a deep inspiration, which is accompanied by a peculiar noise named the hoop; this is repeated till the child brings up a quantity of viscid mucus; after which it recovers, either speedily, or may lie down exhausted and fatigued. During the fit of cough, the face is swollen, purple, and livid; the eyes seem starting from their sockets; sometimes a vessel in the conjunctiva gives way, and the eye becomes bloodshot, or there may be epistaxis, hæmoptysis, vomiting, and in some instances a vessel in the head yields, and the child dies suddenly. The duration of this disease averages six weeks: it ordinarily attacks children, and is almost always epidemic. It commences like a catarrh, which lasts from a week to a fortnight before the

decided diagnostic symptoms of the disease show themselves. It is very fatal to children, and requires careful management.

Morbid appearances.—Congestion of the lungs, which are so loaded with blood that they sink readily in water; inflammatory appearance of the mucous lining of the bronchial tubes; sometimes the trachea and larynx contain thick viscid mucus, with lymph and streaks of blood: if the disease be protracted, small tubercles are found scattered about the lungs, which are also in parts softened and ulcerated; sometimes there is œdema of the epiglottis, with inflammation in the pharynx; the vessels of the brain are often gorged with blood, and sometimes we find effusion.

Treatment.—In the early stages, if there is oppression of the breathing, with signs of bronchial inflammation, bloodletting is necessary, and often highly beneficial. Tartarized antimony, or ipecacuanha should be given almost to nausea, and the bowels should be kept moderately open. In the second stage, and in mild cases, the chest should be protected from cold, and indeed the surface of the body generally. The diet should be light. Counter-irritation upon the chest, by stimulating liniments and tartarized antimony, is useful; and an emetic given daily, or every other day, is serviceable. I have found vinum ipecacuanhæ to answer best; and, if given in the evening, it unloads the stomach, produces some exhaustion, and a quiet night is the fruit of it. As a general remedy, I have found ipecacuanhæ, in small doses with conium, given three times a day, to answer best. In addition to the measures mentioned above, with some practitioners, belladonna and

hydrocyanic acid are favorite remedies. Change of air has the reputation of contributing to the cure.

Pneumonia, Inflammation of the lungs.

Symptoms.—Pyrexia; hot skin; dyspnœa: there is a sensation of constriction; painful cough; the pain is more obtuse than in pleuritis, but there is a greater sensation of oppression. The respiration is quick and difficult, and the countenance often assumes a purple colour. The pulse is generally quick, and not very full. The expectorated matter is at first muco-sanguinolent, but becomes afterwards thick, opaque, and puriform. When suppuration takes place, it is known by rigors coming on, the pain is more fixed, and there is hectic fever.

Physical and stethoscopic signs.—For describing these, the disease is usually divided into three stages.

In the first stage, the râle crepitant is very distinctly heard, together with the usual respiratory murmur; on percussion, the sound is almost as clear as in health, but as the disease proceeds, it becomes gradually more obscure.

In the second stage solidification takes place, and there is no crepitous râle, nor respiratory murmur heard: in the sound part of the lung, the respiration is more audible, and is named *puerile*. There is a dull sound on percussion over the affected part. When the lung is diseased near the large bronchi, there is bronchophony.

In the third stage, purulent infiltration takes place, and is known by a mucous râle, and if the pus be accumulated in a part, and afterwards discharged, the cavernous râle and pectoriloquy will be heard.

Morbid appearances.—In the first stage, redness from congestion of the vessels, which pour out blood freely, if the lung be cut into; and increase in the weight of the lung. In the second stage, the colour is variable, but never so red as in the first the lung crumbles or breaks down between the fingers, and crepitation is lost in the part. In the third stage, the lung is hard and heavy, and when cut into and compressed, a quantity of sanguineous grey or purulent fluid is seen to ooze out from several parts. Crepitation also is lost. A distinct abscess is an exceedingly rare occurrence. The pleura often partakes of the disease, and presents many patches of lymph, and some which have produced adhesions. Gangrene has been met with in some very rare instances, and is easily recognized by the black appearance and intolerable fœtor of the part.

Treatment.—Bleed freely from the arm, and more locally by leeches and cupping; give brisk purgatives; apply blisters; great reliance may be placed in nauseating doses of tartarized antimony and ipecacuanha. Some practitioners administer calomel with small doses of opium.

Pleuritis, Inflammation of the Pleura.

Symptoms.—Pyrexia; acute pain in some part of the chest, increased by taking a deep inspiration; percussion is painful; there is immobility of the ribs corresponding with the affected part; in-

spiration is hurried, but expiration is comparatively slow. The breathing is not so sensibly oppressed as in pneumonia. The pulse is quick and hard, in feel resembling whipcord, which is generally the case when the serous membranes are inflamed. The skin is hot, and the tongue much furred. The expectorated fluid is more watery than that in pneumonia and bronchitis.

Physical signs.—There is often a dull sound on percussion. The respiratory murmur is diminished and subsequently lost: with slight effusion there is ægophony: if, during the disease, ægophony is evident, then ceases with the progress of the disease, and afterwards reappears, it is a favorable symptom. When the effusion is considerable, the affected side is perceptibly enlarged.

Pleuritis terminates in effusion of a yellowish serous fluid, empyema, and by forming adhesions between the pleura costalis and pulmonalis.

Morbid appearances.—The pleura is more vascular than natural, with red spots, like ecchymosed blood underneath the membrane; there is deposition of lymph, sometimes in several layers; effusion of serum, with flocculi of lymph in it, such as we find in peritonitis; lymph, agglutinating the pleura costalis and pulmonalis together, by becoming organized; the lung very much compressed, lying close to the spine. Mortification and ulceration of the pleura are extremely rare. Amongst the consequences of pleuritis, empyema must be enumerated; but this is by most thought to be a production of a chronic form of pleuritis. The pus also might get into the cavity by the bursting of the vomicæ. To remove the fluid paracentesis is performed, and in several cases has

allowed the cure of the patient. The symptoms accompanying are very much the same as those to be described as belonging to hydro-thorax.

Treatment.—The means to be employed are the same as those necessary for pneumonia. Bloodletting is employed in most cases more repeatedly, and calomel may be more relied upon.

Hæmoptysis, Spitting of Blood.

Spitting of blood, brought up from the lungs, may depend upon three principal causes, viz. exhalation of blood upon the surface; rupture of a congested vessel, as in apoplexy of the lungs: and ulceration, or erosion of a vessel of a tuberculous cavity.

Symptoms.—There is a sensation of weight and oppression at the chest; a tickling feel about the larynx, trachea, and bronchi; a dry cough and dyspnœa; a pulse generally full and hard; the tongue is white; a saltish taste in the mouth; and, in a fit of coughing, a quantity of blood is brought up, which is of a florid red colour and frothy, but sometimes black and clotted.

Physical signs.—In the simplest hæmoptysis, auscultation discovers only a slight mucous râle in the part of the lung affected. The sound on percussion is like that in health.

In *pulmonary apoplexy* there is dulness of sound over the part affected, the respiratory murmur is wanting, and there is a crepitous râle in the surrounding parts.

Morbid appearances.—In the first variety which scarcely ever kills, coagulated blood is found in the bronchial tubes; the mucous mem-

brane is soft, tinged with blood, and its vessels much congested. In pulmonary apoplexy, parts of the lungs are found indurated, and of a very dark colour. This seems to be produced by a gradual deposition of blood into the parenchymatous structure of the lung; and is most common at the posterior and inferior parts. The third variety is attendant upon phthisis pulmonalis, and is usually treated of under that subject.

Treatment.—It is often necessary to take away blood from the arm. The patient should be kept perfectly quiet, and at a cool temperature; he should take cold acidulated drinks, and the diet should be of the mildest nature. The medicines most useful are, purgatives, acetate of lead, sulphuric acid, digitalis, and most of the astringents.

Phthisis, Pulmonary Consumption.

Symptoms.—In the first stage, during the formation of tubercles, there is cough, with slight expectoration, languor and debility, and a quick and soft pulse. In the second stage, the tubercles being increased, oppress the lungs, producing dyspnœa; hæmoptysis often supervenes at this period. In the third stage, the tubercles are softened, and purulent matter is ejected; there is hectic fever, with nightsweats, emaciation, and purulent expectoration, with some pain. There is frequently a flushed cheek; diarrhœa is a common attendant, and is mostly occasioned by ulceration of the intestines.

The upper lobes of the lungs are more frequently the seat of the disease.

Physical signs.—In the first stage the stethoscope does not convey much information; the respiration is less perfect in the part affected, there is a slight crepitous râle, and some dulness of sound on percussion.

In the second stage, the tubercles increasing in number; there is a dull sound on percussion; the respiratory murmur disappears; the breathing is bronchial, and there is bronchophony.

In the third stage, that of softening, various sounds are heard, according to the condition of the part, viz., a deep gurgling perceived during coughing; when a communication is formed between a cavity and the bronchial tube, we have cavernous respiration and cavernous ronchus, and pectoriloquy; if the cavity be very large, amphoric resonance and metallic tinkling. The sounds given by percussion may be clear and loud.

Morbid appearances.—Adhesion of the pleura to the walls of the chest; the lungs present an uneven, unequally hard surface on pressure; in parts they are more solid than natural, in others soft and yielding; on cutting into them whitish tubercles are scattered over various parts, more numerous in the upper than lower part of the lungs; amongst these, large cavities are seen, either separate or many communicating together, in some places filled with purulent fluid. These cavities contain a thick purulent pulpy fluid which adheres to the walls: across them fibrous bands are stretched, consisting partly of the obliterated vessels and tissue of the lungs. In the parts surrounding the tubercles, and even occupying an entire lobe, there is tubercular infiltration; some-

times a large cavity has opened into the bag of the pleura, and formed that state of disease named empyema.

In addition to these we notice great emaciation of the whole body, contraction of the chest, serum in the pericardium; the lining membrane of the bronchial tubes thickened and inflamed, and that of the trachea and larynx red and sometimes ulcerated; the mucous membrane of the stomach is sometimes inflamed, thickened, and pulpy; the small intestines, especially the ilium, presenting ulcerations; and there are tuberculous deposits in the mesenteric glands, and many other parts of the body.

Treatment.—The remedies employed are, blood-letting in small quantity; purgatives, sedatives, acids, rubefacients, and blisters. In the commencement, removal to a warm climate may retard the development of many of the symptoms and progress of the disease; but, when vomicæ have once been formed, there are but slight hopes of any recovery.

Asthma.

Symptoms.—A periodical difficulty of breathing, generally coming on about evening, and diminishing in the morning. There is a sensation of tightness and fulness of the chest. Expiration is accompanied with a wheezing sound. At the commencement of the paroxysm there is very little cough; but, towards the end, there is a free cough, with expectoration of mucus. The face is much flushed, and of a livid tinge. It is described as

consisting of two species, the moist, and dry or spasmodic asthma.

The pathology of this disease is exceedingly obscure, and the post mortem appearances contribute little towards giving us information. Some of the air-cells are found dilated much beyond their natural size, and sometimes air is found between the air vesicles, and may be named intervesicular emphysema; the bronchial tubes are sometimes dilated and contain some viscid mucus; the disease is often complicated, with dilatation of one or more cavities of the heart, or disease of the valves. It is frequently associated with chronic bronchitis, and is by some referred to spasmodic contraction of the bronchial tubes; others impute it to peculiar condition of the nervous system.

Emphysema of the lungs during life is ascertained by the diminished respiratory murmur in the part affected, at the same time that there is clear sound upon percussion.

Treatment.—The remedies most efficacious are, bloodletting in small quantity, the foot bath, laxatives, emetics and counter-irritants, and, in some cases, opium. In spasmodic asthma, stramonium taken internally or smoked, and the lobelia inflata, are often serviceable.

DISEASES OF THE CIRCULATORY SYSTEM.

Angina Pectoris.

Symptoms.—A sudden pain is felt across the chest, and particularly about the heart; there is a sensation of constriction, approaching to suffocation: difficulty of breathing. These symptoms

come on in paroxysms, particularly after walking or eating. The pulse is weak and irregular; the countenance pale; there is cough, and slight expectoration. There is sometimes difficulty in lying down, and, occasionally, a peculiar sensation of numbness extending down the arm.

The pathology of this disease is still obscure. The most frequent morbid state associated with it is ossification of the coronary arteries: other diseased conditions of the heart sometimes attend it, such as ossification of the valves, and disease of the aorta: in some instances it might be referred to the morbid state of the liver or stomach, or to a neuralgic state of the thoracic nerves.

Treatment.—Moderate bloodletting sometimes relieves; sometimes carminatives and antispasmodics: the lightest food only should be allowed, and all active exercise and mental agitation guarded against; issues, blisters, and mineral tonics, are found serviceable.

Carditis, Pericarditis, Inflammation of the Heart and Pericardium.

Symptoms.—Pain in the region of the heart, of a dull oppressive character, soreness in the corresponding intercostal spaces and epigastrium, if pressure be made upwards; palpitation; the motion of the heart very perceptible, even at some distance; hurried respiration, anxious expression of countenance; the pulse is frequent and bounding, after a time irregular; there is a dry cough, and a feeling of sinking or faintness on exertion. The tongue is white; sometimes there is moisture on the skin as in rheumatism.

The disease is almost limited to the pericardium, but in some cases affects the substance of the heart. According to some pathologists the lining membrane of the heart is always affected. It most frequently accompanies or follows acute rheumatism.

Physical signs.—The pulsation of the heart is felt over a larger space than usual: percussion may give a more dull sound; the movements of the heart are hurried and jerking, sometimes intermitting and irregular, and there is often a bellows' sound. In the second stage, when effusion has taken place, auscultation affords various sounds, like the rubbing of paper or parchment, or of the bellows or sawing kind; in some instances the sound resembles the creaking of new leather. In the stage of copious serous effusion the impulse of the heart is little perceived; there is more dulness on percussion, and the sounds of the heart are less audible. The pulse is then weak and irregular.

Morbid appearances.—The pericardium is of a florid red colour, with great injection of its vessels; there is serum containing flocculi of lymph; the heart and bag of the pericardium are coated with lymph, and sometimes there are adhesions; the heart itself is unusually vascular, and sometimes contains pus in its substance; frequently there are inflammatory appearances in the surrounding parts.

Treatment.—Bleeding from the arm and locally, by leeches or cupping, after which mercury is the medicine most to be depended upon; it should be given so as to affect the mouth; a blister over the heart may be useful after leeching: purgatives

and salines, with tartarized antimony may be given. The recumbent position is absolutely requisite. If the disease follows rheumatism, colchicum also is used.

DISEASES OF THE BRAIN AND NERVOUS SYSTEM.

Inflammation of the Membranes of the Brain.

Symptoms.—This disease presents symptoms so varied, that no short description can convey an adequate idea of it. There is pyrexia; a quick jerking pulse; pain about the head, particularly at the vertex; tinnitus aurium; disturbed intellect; raving delirium; in the latter stages, convulsions; coma, and paralysis: the bowels are generally costive, and the skin hot and dry. The tongue is furred; and, when, protruded, is often inclined to one side. There is sometimes squinting; and the pupil, which is at first contracted, becomes in the latter stages dilated.

Morbid appearances.—Great vascularity of the dura mater, sometimes ulcerated, and with pus beneath it; the arachnoid is thickened and opaque, bathed with a quantity of serous fluid; the pia mater has its vessels exceedingly congested, or covered with pus; the vessels in the brain appear to contain more blood than usual, and there is serous effusion in the ventricles.

Treatment.—Blood may always be taken away, either from the arm by the lancet, or from the temples by arteriotomy, or by leeches. Drastic purgatives should be given, and frequently repeated; the head should be shaved and cold

applied to it nearly constantly. Blisters and sinapisms may be applied to the extremities, but not to the head or in its immediate vicinity. Calomel is a remedy of the greatest value in this disease.

Inflammation of the Substance of the Brain.

Symptoms. — The symptoms resemble very closely those arising from inflammation of the membranes. There is pain and a sensation of weight in the head; vomiting; tinnitus aurium; strabismus; difficult articulation, and great restlessness; in a short time convulsions come on, and are followed by paralysis or coma. The flexors of the paralyzed limb are often contracted. There is frequently constipation, and the patient generally lies upon his back.

Treatment.—The same treatment is required as for the inflammation of the membranes of the brain.

Delirium Tremens.

Symptoms.—Wild countenance, restlessness and sleeplessness; the tongue is white and tremulous; the pulse rather quick, but not full or strong; the skin often moist; mental delusion, with considerable fear and anxiety; the bowels are generally constipated, and most of the secretions are disordered. The pupil is often contracted, but in some instances is much dilated: the hands and feet are ordinarily cold and clammy. These symptoms may last three or four days, and will then be carried off by a sound sleep; but, in unfavorable cases, the powers sink gradually, and the patient dies in con-

vulsions. It is generally occasioned by drinking stimulating liquors to excess.

Treatment.—At the commencement, leeches may be applied to the head, but general bleeding is inadmissible; a dose of calomel and some mild purgative may be given, and be followed by opiates in large doses. A combination of tartarized antimony, with opium, is reported, in several cases, to have been very successful. Sometimes it is necessary to give a portion of the habitual stimulus, such as gin, brandy, &c., or substitute for it such as ammonia and ether.

Hydrocephalus. Water in the Head.

The progress and symptoms of this disease are very variable; sometimes it similates the phrenitis of adults, and carries off the patients in a few days, and then properly might be designated acute, or the water stroke: more frequently its progress is slower, and certain stages may be distinguished. It mostly attacks children from two to seven years of age.

Symptoms.—Of the first, or premonitory stage: quick pulse, white tongue, hot skin, and disturbed sleep; loss of appetite, thirst, occasionally vomiting; indisposition to exertion; wasting of the body and febrile exacerbations towards the evening, with other symptoms, such are linked with infantile remittent fever.

In the second, or inflammatory stage, the skin is dry and hot; the face flushed; the eyes red; the hands carried often to the head; screaming suddenly, both when awake or during sleep; great restlessness; fear of falling; intolerance of light and sound; contracted pupil; bowels often relaxed, with green slimy fœtid stools.

In the third stage, or that of effusion, the pulse is slow and very irregular; the pupils dilated; there may be strabismus, coma, constant moaning, with occasional short screaming; grinding of the teeth; partial paralysis; one eye often reddened, with thick viscid secretion adhering to the lids, and falling of the upper eyelid; occasional convulsive fits.

In the fourth stage, or attempt at reaction, the pulse rises to 140 or 160, the skin hot and dry; total insensibility; involuntary discharge of the fæces; the lips are dry and cracked; the tongue dry; inability to swallow; startings of the limbs; and a convulsive fit carries the patient off.

Morbid appearances. — Inflammation of the membranes; the convolutions of the brain flattened; the substance of the brain softened; the septum lucidum often broke down; collection of fluid in the ventricles, which does not coagulate by heat, like the serum of the blood; fluid is also found between the membranes, whence a distinction has been made between hydrocephalus externus and internus.

Treatment.—General and local bloodletting; cold applied to the head, drastic purgatives, calomel, blisters, digitalis, pediluvia, mustard cataplasms, &c.

Chronic hydrocephalus is known by the immense size of the head; the bones become separated, and consequently the spaces named fontanelles are very perceptible; the rest of the body is usually in an atrophied state; the intellect often is not impaired, and the functions of the body are carried on without much difficulty, till more acute symptoms show themselves, and carry off the

patient. This morbid state may exist for many years.

The *morbid appearances* in the head are flattening of the surface of the brain; general softness, and a large collection of fluid in the ventricles, which communicate freely together.

Treatment.—Attend to the general health; give occasional doses of hyd. c. cretâ and mild tonics; let the head be kept cool. It has been proposed to tap the head, and afterwards compress it; the practice is old, but has, during the last few years, been advocated strongly by Dr. Conquest; I have seen some operated on, but never thought or found that life was much protracted by the operation.

Apoplexia, Apoplexy.

Symptoms.—Sudden loss of power, sense and motion; coma; stertorous breathing; countenance usually pale or livid; pupil generally dilated; the teeth clenched; foaming at the mouth; pulse full, and generally slow. The premonitory symptoms are such as arise from determination of blood to the head.

It comes on sometimes more gradually, with faintness, pain in the head, and vomiting; and in a few hours subsides into coma. The first symptoms in other cases, are paralysis of one side and loss of speech; in a few hours, merging into the apoplectic fit.

Morbid appearances.—Effusion of blood into substance of the brain, into the ventricles, or between the membranes, varying considerably in quantity; effusion of serum in the ventricles, or

upon the surface, with great turgescence of the vessels; sometimes apoplectic cysts or cells, from which blood has been absorbed, with some discoloration and softness of the surrounding substance; sometimes the arterial branches at the base of the brain are found in an ossified state. In some rare instances, no morbid appearance can be discovered.

A division of apoplexies is sometimes made into sanguineous, serous, and nervous, without sufficient foundation, and without aiding us in the diagnosis and treatment. If a weakly, spare, aged person be seized with apoplexy, it is suspected to be serous or nervous, although in the majority of cases there is extravasation of blood. A difference may be made in the treatment: depleting measures must be more moderate; counter-irritation more relied upon; and, if the powers collapse, diffusible stimulants may be requisite. An admirable account of these varieties will be found in a work by Dr. Cooke, on "Nervous Diseases."

Treatment.—Bloodletting, general and local; drastic purgatives, such as croton oil; cold applications to the head, and a blister to the nape of the neck: sinapisms to the feet; irritating injections; the head should be kept elevated; and a brisk action on the bowels should be kept up for some days.

Paralysis, Palsy.

Symptoms.—Loss of motion in some part of the body, preceded either by apoplexy, or by a diseased state, known by a tingling sensation, pain in the head, and loss of memory. Loss of motion in

one side is named hemiplegia; and when it affects the lower extremities, paraplegia.

In *hemiplegia* there is generally paralysis of the muscles of the face, which are drawn up towards the healthy side; the tongue, when protruded, inclines to one side, generally to the paralyzed one; there is difficulty in articulation and swallowing; and the heat of the paralyzed limb is less than in the healthy side; the pulse there is also more feeble.

Morbid appearances.—We may have the same as are found in apoplexy; or there are tumours, cysts, or parts of the brain changed in colour and consistence, and collections of matter: in some cases, no discoverable lesion. The morbid appearances are almost always found in the side of the brain opposite to the paralyzed parts.

Paraplegia, or paralysis of the lower extremities, is dependent either upon disease of the brain, or spinal marrow. Cerebral paraplegia is most frequent in advanced age, and generally comes on gradually. The urine and fæces escape insensibly; sloughs are likely to form on the nates; and the patient dies, gradually exhausted. Cases of recovery are exceedingly rare. Spinal paraplegia may come from injuries or inflammation, and is not uncommon in scrofulous children, when the spine is affected with curvature. Many other varieties of paralysis, more localized, are described in larger works.

Treatment.—In most cases, the same measures, but more moderate, may be employed here, as in apoplexy; and when plethora and increased action have been subdued, counter-irritation may be useful, in the form of a blister to the back of the

neck, or back part of the shaved scalp; stimulating embrocations, and friction over the paralyzed part; mercury in moderation, and iodide of potassium, to promote absorption: electricity, and the use of strychnia, are the usual adjuncts employed.

Tetanus, Rigid Spasm.

Symptoms.—Rigid spasm of the voluntary muscles of some portion of the body. It generally commences in the muscles of the neck. The spasmodic contraction of the muscles of the jaw and throat is called *trismus;* that of the muscles of the back, in which the body is bent backwards, is called *opisthotonos;* when the body is bent forwards, *emprosthotonos;* and, when bent laterally, *pleurosthotonos.*

The disease is divided into traumatic and idiopathic. The disease comes on gradually, with stiffness in the neck and pain on motion, uneasiness in the throat, and deglutition difficult; afterwards the jaws become firmly fixed by the temporal and masseter muscles; the spasmodic action then extends to the muscles of the trunk, and is often accompanied with a severe pain shooting through the chest. There are sometimes slight remissions, after which the spasms return with increased violence, and the patient dies horribly convulsed.

Morbid anatomy throws very little light upon the disease; but if there be one appearance more common than another, it is inflammation of the theca vertebralis in the neck, and increased vascularity about the medulla oblongata.

Treatment.—The treatment must vary according to the causes and probable effects on the system. If it arise from wounds, and there is evident inflammatory diathesis, bleed largely from the arm; use the cold bath, and cold affusion; give purgatives and mercury to salivation, and prussic acid. Idiopathic tetanus requires powerful antispasmodics, such as opium, musk, camphor, and ether, warm bath, Peruvian bark and wine, embrocations, and stimulant applications externally. Of all the remedies, opium and calomel in large doses hold out the best promise.

Epilepsia, Epilepsy.

Symptoms.—The disease is characterized by fits, which are accompanied by the following symptoms: sudden loss of sense and voluntary power, pupil fixed and immoveable; respiration hurried, with an apparent sense of suffocation; convulsive fits, with spasmodic contraction of various muscles of the body, especially those of the face. They gradually diminish, but leave the person still insensible, and apparently comatose. The fit is generally preceded by a cold sensation, like something creeping up the body, and is called *aura epileptica;* and often by pains in the head, and unusual distressing feelings. Other varieties of epileptic fits are described, such as *tetanoid*, with tonic spasms, or protracted rigidity of the muscles; another in which there is insensibility with relaxation of the muscles; and a third, which has received the name of *catalepsy*, in which the limbs remain rigidly fixed in any position which

bystanders may put them in. The causes, or states of system connected with the disease, are various, such as dentition, worms, other irritants in the intestinal canal, excessive drinking of spirits, hysteria, excessive sexual intercourse, profuse evacuations by hemorrhage or purging, and several organic changes. In many cases no cause can be detected, either during life or after death.

Morbid appearances. — Those found in the head are congestion of the vessels, thickening of the membranes with ossific deposits in them; tumours and abscesses; the cerebellum is most frequently diseased of the parts of the head. I would again refer the reader to Dr. Cooke's excellent work on Nervous Diseases for the history of this disease.

Treatment.—During the fit, prevent the patient from hurting himself; if plethoric, bleed from the arm, jugular vein, or temporal artery; if debilitated, give stimulants and antispasmodics. During the interval, apply the treatment requisite for the plethoric or debilitated condition of the system. It is in this disease that nitrate of silver has been so frequently administered, and is resorted to when the disease appears to be independent of organic affection, and the pathology of it is totally obscured.

Chorea, St. Vitus's Dance.

This disease more frequently attacks females, and those only who have not arrived at puberty, most commonly between the tenth and fourteenth year.

Symptoms.—Convulsive motion, affecting generally the extremities of one side only. The muscles of the face, and indeed all the voluntary muscles are sometimes affected. These motions are observed most in an attempt being made to walk or to grasp any thing. The pulse is generally quick, and there is an unhealthy appearance of the eyes and complexion; the intellect is also impaired. It depends either upon worms, hardened fæces, sometimes constitutional debility, irritation in the spinal chord, and irregular action of the nervous system. It generally lasts two or three months, sometimes for years.

Treatment.—The disease has been cured by free purging, long continued, according to the plan of Dr. Hamilton; also by tonics, as sulphate and sesquioxide of iron, sulphate of zinc, Fowler's solution, &c.; by powerful shocks produced on the body and nervous system, as by the cold or shower bath; and by leeches and blisters applied to the spine.

Hysteria, Hysterics.

Symptoms.—The hysterical fit comes on with faintness, agitation, convulsive startings, hurried breathing, chiefly abdominal, and very forcible; the face pale, the eyes turned upwards, insensibility, throwing about of the arms, beating of the chest, clenching of the hands, and powerful muscular contraction. These are followed by sobbing, and sometimes by immoderate fits of laughter, and afterwards by the discharge of much limpid urine; when sensible, the patient complains of a sensation like a ball rising in the throat, named

globus hystericus, and a severe pain referred to the head or side, which is called *clavus hystericus*. The symptoms are exceedingly variable in different cases.

Treatment.—Bloodletting, if the patient be young and plethoric; apply stimulants to the nose and temples; dash cold water over the face and neck; give antispasmodics, purgatives, and tonics, after the attack.

DISEASES OF THE SKIN.

Erysipelas, St. Anthony's Fire.

Symptoms.—Erysipelas always commences with febrile symptoms, which accompany it till its termination. There is nausea and vomiting; pulse generally hard and full. About the second or third day, the eruption appears of a deep red colour; the inflamed part is much swollen, and has a sensation of tingling and great heat. When the head and face are attacked, (which is of frequent occurrence,) great pain is felt, and confusion of thought and delirium ensue. The face becomes very œdematous, and the eyes are closed. The eruption terminates in a few days by desquamation, phlyctenæ or vesicles, and the symptoms gradually subside. Œdematous effusion is a frequent attendant and consequence of idiopathic erysipelas.

Causes.—Checked perspiration; abuse of liquors; but most frequently some irritating matters in the primæ vitæ. It may be called also traumatic,

from occurring so repeatedly in hospitals after wounds or operations.

Treatment.—The treatment at first must be purely antiphlogistic, modified according to the age and constitution of the patient. Emetics at the commencement are generally very useful, and should be followed by a dose of castor-oil, and, subsequently, saline purges. Wine, bark, and stimulants in general, may be given to debilitated persons. When the violence of the inflammation has abated, cold spirituous lotions may be applied to the part affected. Numerous external applications have been advocated, such as common flour sprinkled over the part, cotton, as in burns, mercurial ointment, a solution of nitrate of silver, &c.

DISEASES OF THE URINARY AND GENITAL ORGANS.

Nephritis, Inflammation of the Kidney.

Symptoms. — Pyrexia, nausea and vomiting; pain in the region of the kidney, which is felt along the course of the ureters; in the male, there is often a retraction of the testicle, or a sensation of pain in it; a numbness in the leg and thigh of the affected side; urine scanty and high coloured, sometimes tinged with blood. The disease is very apt to terminate in suppuration, which may be detected by pus passing away with the urine. Nephritis is often induced by a stone in the kid-

ney; sometimes by cold, external violence, or powerful diuretic remedies.

Diagnostic character. —Retraction of the testicle, and vomiting; pain not materially increased by the erect position.

Treatment.—General bloodletting, and local by leeches or cupping, cathartics, diaphoretics, and copious mucilaginous drinks; warm bath; mercurials, in moderation, may be used. Blisters and the powerful diuretics are improper, as they are apt to induce strangury, and to increase the severity of the symptoms.

Cystitis, Inflammation of the Bladder.

Symptoms. — Pyrexia; pain and tenderness about the perineum, with heat, and sometimes swelling in the hypogastrium; frequent attempts to make water, which is evacuated high-coloured, ropy, in small quantity, and with great pain; there is often tenesmus, sickness, and occasionally delirium. It may come on from over distension, cold, extension of inflammation in gonorrhœa, presence of calculi, and use of violent diuretic remedies.

Treatment.—Similar to that for nephritis.

Diabetes, Excessive Secretion of Urine.

Symptoms.—The most characteristic feature in this disease is the excessive flow of urine of a particular quality, which sometimes amounts to as much as twenty pints in twenty-four hours. By

Drs. Prout, Copland, and others, the term is restricted to that form of diuresis, which is attended by a secretion of saccharine matter, known as diabetes mellitus, and not including diabetes insipidus. The urine is pale straw-coloured; of a faintish odour, taste saccharine, specific gravity from 1·025 to 1·050. Urea and uric acid, as well as the usual saline ingredients, are diminished in quantity. There is generally languor, lassitude, and debility, dry and occasionally hot skin, some fever, strong appetite, constipated bowels, pains in the back, along the course of the ureters, the prostate and urinary passages generally. But the constitutional symptoms have been so various in different people, that they cannot be laid down with any precision.

The *morbid appearances* in the kidney have chiefly been enlargement with redness, or softened, pale, and flaccid, with a similar condition of the renal vessels.

Treatment.—The treatment must vary, according to the individual and period of the disease: on general principles, bloodletting, either from the arm or locally, may be employed; the bowels should be rather freely acted upon, by colocynth, scammony, and such purgatives, but not by salines. The surface should be kept warm to excite diaphoresis, and even irritated by rubefacients, or vesicants. The food should be chiefly animal, with a small proportion of drink; opium and astringents have been largely used, and especially the first, with good effect. The spiritus terebinthinæ has been given at the Middlesex Hospital recently, with marked benefit, in doses of twenty to thirty minims, three times a day.

Hysteritis, Inflammation of the Uterus.

Symptoms.—Pyrexia; pain and tension in the hypogastric region, the pain being increased upon pressure; vomiting; when the inflammation is slight, there is a frequent desire to pass the urine and fæces; if the inflammation runs high, there is constipation and dysuria. Pure hysteritis is of very rare occurrence.

Treatment.—The usual antiphlogistic measures.

Hæmaturia, Voiding of Blood through the Urethra.

Symptoms.—Pain, with a sensation of weight in the loins, and in the region of the kidneys. The urine is evacuated, mixed with blood, which may come from the kidnies, bladder, or urethra. It is generally a symptom of other diseases, sometimes accompanying hæmatemesis, and other diseases of a hæmorrhagic nature.

Treatment.—The treatment must depend on the precise seat of the affection; therefore, the antiphlogistic remedies must be adopted, according to the part affected.

Chlorosis, Obstruction of the Menses.

Symptoms. — Dyspepsia; pale countenance; listlessness, and disinclination for exercise or fatigue; palpitations, dyspnœa, and occasionally syncope. Depraved appetite, and dislike to usual food; the legs become sometimes œdematous.

The colour is referred by some pathologists to a deficiency of red particles in the blood. The pulse is commonly weak, and there is general languor of the system. If not corrected, anasarca is likely to supervene, and afterwards phthisis sometimes manifests itself.

Treatment.—A light nutritious diet; gentle exercise, particularly on horseback; warm tonic purgatives, especially aloes; the preparations of iron are singularly efficacious, when combined with mild aperients: tonics may be given, such as cascarilla, chamomile, gentian, &c.; and, when there is great languor, stimulants are admissible, such as camphor and ammonia; to these we may add the cold and warm bath, chalybeate waters, and electricity.

Menorrhagia, Immoderate Flow of the Menses.

Symptoms.—Great discharge of menstrual fluid or blood, accompanied by pain in the back and loins. There is generally pyrexia; it occurs both to plethoric and debilitated habits, and may depend upon inflammation of the lining mucous membrane of the uterus, polypi, and other organic diseases of this viscus.

Treatment.—The remedies to be employed are bleeeding and purgatives for the plethoric; for the debilitated, cooling astringents; the horizontal position is necessary in all cases, and cold may be applied to the pubes.

DISEASES PRINCIPALLY ATTACKING FIBROUS AND SYNOVIAL MEMBRANES.

Podagra, Gout.

Symptoms.—Pyrexia; disordered state of the digestive organs; pain, swelling, and redness of the smaller joints, most frequently of the great toe. The violence of the symptoms recurs in paroxysms, being most severe towards night. In some cases, the pain of the joints is less severe, and some viscus is more particularly attacked, constituting *podagra atonica.* In *podagra retrograda,* the swelling suddenly disappears in the joints, and a metastasis takes place to the stomach, or some other viscus. After a part has been attacked with the gout, it is sometimes found to be enlarged, and uneven on its surface, occasioned by a deposit in or underneath the skin, of a calcareous appearance, named *chalk-stones,* or *gouty concretions;* the composition of which is uric acid and soda. *Query:* Might not the presence of this acid in the blood, where it should not be, and does not exist naturally, be the cause of the peculiar inflammation, notwithstanding the opposition of the anti-humoral pathologists?

Gout is one of those diseases called hereditary, seldom coming on before the age of puberty, and more generally attacking males. It is commonly preceded by, or dependent upon, some disorder in the functions of the stomach, small intestines, skin, or liver; and the more immediately exciting causes are excess in diet, want of exercise, sup-

pressed evacuations, and depressing emotions of the mind. The parts attacked by it in common cases, are the skin, the cellular, fibrous, and serous membranes.

Diagnosis between gout and rheumatism. Gout scarcely ever occurs before puberty; is generally preceded and accompanied by considerable disorder of the alimentary canal; is generally seated in the great toe on the first attack; and the inflamed part is more tumid, more painful, and of a brighter red colour.

Rheumatism is brought on by exposure to cold; comes on more suddenly; has not the remissions, like gout, and attacks fewer structures at the same time.

Treatment.— Mildly antiphlogistic. Bloodletting is seldom required; cooling laxatives may be given, and the affected part may be enclosed in flannel, so as to excite diaphoresis. Colchicum is found almost a specific in removing the acuteness of the pain. Rest in recumbent posture is necessary.

Chronic gout must be treated by attention to diet, abstinence from heating liquors, gentle exercise, mild aperients, and sudorifics. If internal inflammation comes on, venesection may be necessary, and leeches may nearly always be applied over the part attacked.

Rheumatismus, Rheumatism.

Symptoms of the acute form.—Pyrexia; swelling, redness, and tension of the larger joints; urine high coloured, occasionally profuse perspiration; the pulse is frequent and full, but gene-

rally compressible. There is a tendency in the inflammation to change its seat from one joint to another. Sometimes the heart becomes attacked. Its most frequent cause is exposure to wet and cold.

In chronic rheumatism, the part affected is not always red, but is rigid and painful on pressure. When chronic rheumatism attacks parts about the hip in the course of the sciatic nerve, it is called *sciatica;* when it attacks parts about the lumbar fascia and muscles, it is called *lumbago.*

The seat of the rheumatism is in the fasciæ, cellular membrane, muscles, synovial membranes, and sheaths of the nerves.

Treatment. — Common antiphlogistic; general and local bloodletting; purgatives; colchicum; diaphoretics: narcotics and fomentations are of great benefit: amongst the plans of cure pursued, some give cinchona, some rely upon calomel and opium, and others give blue-pill, in repeated doses, till it slightly affects the mouth. Chronic rheumatism is to be combated by colchicum, guaiacum, Dover's powder, warm bath, small repeated doses of mercury, blisters, exercise, and friction.

HYDROPES.

Dropsies.

Dropsical effusions may result from several different morbid states. They may depend upon membranous inflammation; or upon mechanical obstruction, as by tumours, or enlarged and hardened viscera pressing upon the large venous

trunks, thus preventing the free flow of blood, so that the vessels are compelled to relieve themselves by discharging a portion of their limpid contents. They may also depend upon general debility of the system, when the exhalants become patulous, from the weakened nervous energy which usually presides over secretion. Some explain the effusion by supposing an increased secretion, and decreased power of absorption. The fault, however does not appear to be so much in the absorbents as in the exhalants, for if exhalation be stopped, in nearly every case, the absorbents will rapidly remove the effused fluid. The diseased viscera which most generally bring on dropsy, are the heart, the liver, and the kidneys.

Anasarca, General Dropsy.

Symptoms.—A soft inelastic swelling of the whole body, or greater part of it. If pressure be made on a part, the impression of the finger remains for some time, producing the appearance called pitting. This effusion, when partial, is called *œdema*. It can scarcely be considered idiopathic or primary. It occurs often after scarlatina; but in such cases we generally find effusion in the chest or abdominal cavity, sometimes in the pericardium. Free purging is one of the most effectual modes of removing the fluid in such circumstances. General dropsy has sometimes shown itself rather suddenly in some plethoric persons after exposure to severe cold. The cutaneous exhalation here appears to be entirely checked, and a quantity of fluid is thrown back upon the system. In this case bloodletting will be requisite to dimi-

nish the quantity of circulating fluid, and will be aided by free purging and diaphoretics.

Ascites, Dropsy of the Belly.

Symptoms.—A dense somewhat elastic swelling, or enlargement of the abdomen. A sense of fluctuation is given to the hand on percussion; there is hurried respiration, scanty urine, constipated bowels, œdema of the extremities.

This effusion may depend upon inflammation of the peritoneum, which will be known by the constitutional symptoms, and the tenderness upon pressure over many parts of the abdomen. It is often connected with diseased liver, which causes an obstruction to the passage of the blood through the vena portæ; and in addition may exert mechanical pressure on the inferior vena cava: such cases are generally known by the history of the patient's habits, and by symptoms of hepatic disease, such as tenderness, on pressure, over the liver, a sallow, jaundiced countenance. The spleen by enlargement may bring on this dropsy, also any impediment to the passage of the blood through the right side of the heart. According to Dr. Bright, a diseased state of the kidney is one of the most frequent causes: it is distinguished by the quality of the urine, which is highly albuminous, and may be found to be so by the application of heat to the excreted liquid. The morbid appearances will correspond with the diseases above mentioned. The disease of the kidney is a granular state of the cortical part, sometimes with enlargement and unevenness of surface. The interior is of a more homogeneous structure, not

presenting the defined difference between the two parts. Sometimes it is yellow and mottled, and in others assumes almost a cartilaginous hardness.

In females, pregnancy and ovarian dropsy may be mistaken for ascites, and in some cases, the diagnosis is not very easy, especially when the patient is interested in misleading the medical man.

In ovarian dropsy, there is at first a defined tumour on one side, which enlarges gradually till it occupies nearly the whole abdominal cavity. In this state, the feeling of fluctuation on percussion is less distinct; and it is said that there is a less degree of transparency. The general health may be very little impaired, which can scarcely be looked for in a case of ascites.

Treatment.—If there be any organic disease it must be first attended to; for if the effusion be stopped, the absorbents will soon carry off what has been thrown out. The hydragogue cathartics are very useful sometimes, such as elaterium, colocynth, scammony, and gamboge; and, to get rid of the fluid as quickly as possible, tapping is advantageously practised. Diuretics and diaphoretics should also be employed.

Hydrothorax, Water in the Chest.

Symptoms.—Difficulty of breathing, particularly in the horizontal posture; pale and livid face; purple colour of the lips; scanty urine; starting from sleep; palpitation; and œdema of the legs and feet. When the effused fluid is abundant, it generally exists on one side only.

The *physical signs* are enlargement of the side affected, with projection at the intercostal spaces; dulness of sound on percussion, which may vary with the position of the patient; loss of respiratory murmur; if the voice be audible in the part, it will be bronchophonic; if there be a little fluid in the chest, we may perceive ægophony.

Morbid appearances.—Thickening of the pleura, with layers of lymph; a large quantity of yellowish serum; sometimes with flocculi of lymph; the heart is often found dilated and hypertrophied; or we find in it disease of the mitral valve, or sigmoid valves; sometimes disease of the arch of the aorta; but in some rare instances no organic disease in the neighbourhood is discoverable.

Treatment.—As this disease gradually results from inflammation of the lungs, or pleura, or obstructions in the heart, or aorta, moderate and careful bloodletting is generally indicated, both from the arm, and locally by leeches. Blisters and other counter-irritants are applied, and sometimes tapping is resorted to. The most valuable medicines in these cases are, mercurials, with digitalis, squill, and nitrate of potash, and elaterium.

CLASSIFICATION OF SKIN DISEASES, ACCORDING TO DR. WILLAN.

Ord. 1.

PAPULÆ.

Strophulus.
Lichen.
Prurigo.

Ord. 2.

SQUAMÆ.

Lepra.
Psoriasis.
Pityriasis.
Icthyosis.

Ord. 3.

EXANTHEMATA.

Rubeola.
Scarlatina.
Urticaria.
Roseola.
Purpura.
Erythema.
Erysipelas.

Ord. 4.

BULLÆ.

Pemphigus.
Pompholyx.

Ord. 5.

PUSTULÆ.

Impetigo.
Porrigo.
Ecthyma.
Variola.
Scabies.

Ord. 6.

VESICULÆ.

Varicella.
Vaccinia.
Herpes.
Rupia.
Miliaria.
Eczema.
Aphtha.

Ord. 7.

TUBERCULA.

Phyma.
Verruca.
Molluscum.
Vitiligo.
Acne.
Sycosis.
Lupus.
Elephantiasis.
Frambæsia.

Ord. 8.

MACULÆ.

Ephelis.
Nævus.

OBSERVATIONS ON MIDWIFERY.

THE parts immediately engaged in the process of utero-gestation and parturition, are the female pelvis and genital organs, which form necessarily the first subject to which the attention of the accoucheur is directed.

The *pelvis* is a kind of osseous canal, situated at the base of the vertebral column. The bones which form it are, the *sacrum, coccyx*, and two *ossa innominata*. Each *os innominatum* is divided (in the fœtus, and for some time afterwards,) into os pubis, ilium, and ischium.

These bones are connected together by strong ligaments, particularly at the *symphysis pubis* and at the sacro-iliac *synchondrosis*. The divisions of the true pelvis are into the *cavity*, the *brim* or *upper aperture*, and the *outlet* or *lower aperture*.

The *axis* of the *brim* is in a line drawn from the umbilicus to the extremity of the sacrum; that of the *outlet*, is in a line drawn from the promontory of the sacrum through the centre of the os externum.

The *diameter of the brim* of an average pelvis, taken from the symphysis pubis to the promon-

tory of the sacrum, measures about four inches; the transverse diameter measures five inches; and the oblique diameter, from the depression corresponding with the acetabulum, on one side, to the sacro-iliac synchondrosis on the other, measures $5\frac{1}{8}$ inches. Some writers state the lateral diameter of the brim to be $5\frac{1}{4}$ inches, and the diagonal as measuring $5\frac{1}{8}$ inches.

The *diameters of the outlet* each measure four inches; but the antero-posterior may acquire an additional inch or more, by the yielding of the coccyx, so that the long diameter of the brim and outlet are reversed. The distance from the symphysis pubis to the hollow of the sacrum is about five inches.

For description of the uterus and its appendages, vide anatomy of those parts.

Dimensions of the fœtal head. The length from the chin to the occiput is about five inches; from the occiput to the forehead, about $4\frac{1}{2}$ inches; from the prominence of one parietal bone to that of the other, $3\frac{1}{2}$ inches; and from the vertex to the base of the cranium, three inches.

The head of the fœtus being larger than any other part of the body, ensures to the rest an easy passage.

The bones of the head being imperfectly formed. have spaces between them, called *fontanels*, which allow the bones to overlap each other, when compressed.

The *anterior fontanel*, of a quadrangular shape, is situated between the junction of the frontal and parietal bones; the *posterior* one, of a triangular form, is found between the central junction of the occipital and parietal bones.

The *period of utero-gestation* is generally limited to between the fifteenth and forty-fifth years of age, or as long as menstruation continues. This function commences much earlier, and terminates much later in some constitutions and countries than in others. Its average duration is about thirty years.

When conception has taken place, the ovum is conveyed to the uterus by the Fallopian tubes, covered by the *chorion* and *amnion*. In the uterus, the ovum receives two additional coverings, which are the *decidua vera* and *decidua reflexa*, which latter disappears after about the fourth month.

The *amnion* contains the fluid called liquor amnii, which has several uses. It preserves the fœtus from pressure, assists in forming the wedge to the os uteri during labour, and lubricates the passages.

The *placenta* is a spongy mass, composed of cellular tissue and the ramifications of blood-vessels. It is by some described as divisible into two portions, called fœtal and maternal, through which, changes are effected in the fœtal blood. The placenta is generally attached to the fundus of the uterus.

In cases of twins, there are generally two placentæ, or they may be attached to each other at their edges, with the vessels anastomosing between them.

The *funis umbilicalis* forms the communication between the placenta and fœtus. It is composed of the umbilical vein and two umbilical arteries, connected together by cellular tissue. The average length of the funis is about twenty inches.

An average fœtus, at the end of nine months,

weighs from six to eight pounds, and its length is about eighteen inches.

Symptoms of conception and pregnancy.—At first, a sensation of chilliness, succeeded by febrile excitement; loss of appetite, with nausea and vomiting, particularly occurring on rising in the morning; amenorrhœa; plethora. After some time, the breasts swell, and become painful, and the areola is darkened and enlarged. Quickening occurs a little before the fourth month, and, in consequence of relieving the iliac arteries from pressure, is often attended by syncope. The motion of the fœtus soon becomes very perceptible; and there is gradual increase in the size of the abdomen.

The uterus for some time remains in the pelvis, until by increasing in size, it becomes too large for that cavity: it then rises into the abdomen, and that change of situation is called quickening.

Labour is that natural function of the body by which, at the expiration of forty weeks, or about two hundred and seventy-five days, the uterus contracts upon, and forcibly expels its contents, returning, in a short time, nearly to the same state as before impregnation.

The *diseases* or *disorders* occasioned by the pregnant state are *nausea* and *vomiting; cardialgia; pain in the head; hæmorrhoids*; *costiveness; irritability of the bladder*, with incontinence of urine; *œdema of the labia;* and a *varicose state* of the veins of the lower extremities.

The earliest period at which a child can live out of the uterus is the end of the sixth month. Labour occurring before the full period, but after the child can exist out of the uterus, is called prema-

ture labour; and, if it take place before the sixth month, it is considered as abortion.

The causes or means by which labour is accomplished are the contractions of the uterus, assisted by the abdominal muscles.

The *precursory symptoms* of labour are, generally, a partial subsidence of the abdominal tumour; a glairy mucous discharge, denominated shew; and a frequent desire to evacuate the bladder and rectum.

The *duration of labour* is subject to great variation, lasting from a few hours to several days. First labours are generally the most tedious and painful, in consequence of the distension of the parts unaccustomed to it.

The *first stage* of labour is accompanied by arterial excitement, particularly during the pains, restlessness and cries, nausea and vomiting; in addition to which, are the following symptoms, which afford the diagnostic character.

Pains accompanying each contraction, resembling cramp of the stomach or intestines. They commence generally at the fundus of the uterus, and pass on towards the pelvis, lasting two or three minutes, and recurring after intervals of about ten minutes, sometimes much oftener; they increase in strength and rapidity as the labour advances. The uterus, at the same time, may be felt hard and contracted, by the hand placed upon the abdomen. The os uteri becomes dilated, and the membranes may be felt very tense during the contractions. Then follow, a discharge of mucus tinged with blood, and increased dilatation of the os uteri, with a protrusion of the membranes, of an ovoid shape, from the os uteri, serving as a wedge to assist in the dilatation.

In the *second stage* of labour, after some time, the membranes burst with the expulsive efforts of the uterus, the liquor amnii escapes, and the uterus contracts with greater force upon the fœtus. The os uteri gradually dilates still more, and the child's head becomes engaged in the pelvis. After some time, the external parts relax and dilate, so as to allow the expulsion of the fœtus through the os externum.

The *third stage* is occupied by the expulsion of the placenta, which generally takes place in about half an hour. From the vagina it may be removed without any difficulty.

The position of the different parts of the fœtus in the uterus is generally the same, and such as to occupy the least possible space. The head inclines, and rests upon the thorax; the trunk is bent forwards; the arms lie down by the sides, with the forearms often crossed upon the sternum; the thighs are raised toward the abdomen, with the legs bent upon the thighs, and sometimes crossed, so that the heel is opposed to the buttock of the opposite side, and the feet are towards the front of the legs.

The parts of the fœtus which may present are numerous; but, for practical purposes, may be divided into four classes, which include *presentations* of the *vertex, face, pelvis* or *lower extremities, body* or either *shoulder.*

Vertex presentations are the most favorable, and such as occur in natural labour.

Labours are classified in different ways by different authors; the most simple division is into *natural* and *preternatural.*

In the first are included labours in which the

vertex presents: the pelvis is of adequate dimensions, manual interference is not requisite, and the process is completed in twenty-four hours. In the second division we include protracted labours; labours with presentation of some part of the trunk, with twins, hæmorrhage, or convulsions.

Natural labour. — Mechanical process: first, the head passes through the brim, with the occiput directed towards the acetabulum, more commonly the left; then a turn, equal to the eighth part of a circle, is produced by the inclined plane of the pelvis; the occipital protuberance is carried behind the symphysis of the pubis, and the face towards the concavity of the sacrum. The head then arrives at the outlet, and passes through it; the occiput emerges first, and then the face, sweeping along the concavity of the sacrum. After the passage of the head, the rest of the body escapes ordinarily, with considerable ease.

If the occiput rests upon either sacro-iliac synchondrosis, the face arrives behind the symphysis pubis, and the occiput rests against the concavity of the sacrum. The occiput emerges first, and the face afterwards.

In natural labour, little interference is required on the part of the accoucheur. He may assist the uterine contractions by gentle pressure upon the abdomen during the pains; and, when the perineum is put upon the stretch, the left hand may be applied in such a manner as to give it some support.

When the fœtus is expelled, a ligature composed of thin tape, or of seven or eight pieces of thread, is to be tied tight round the umbilical

cord, at the distance of two inches from the umbilicus; a second is to be applied in a similar manner, at two inches from the first, and then the cord is to be divided between them. The cord attached to the fœtus should then be examined, to ascertain whether any blood escapes; if so, a tighter ligature should be applied.

Attention should then be paid to the placenta, which in common cases comes away very readily.

After it is expelled, place one hand upon the abdomen to ascertain whether the uterus be properly contracted, to guard against the occurrence of hæmorrhage.

If the placenta be not expelled after waiting an hour, assistance will be required to extract it, which will depend upon the causes of retention.

The placenta may be retained in the uterus from loss or want of power of contraction; by irregular contraction, by means of which it is forcibly retained; and by adhesion to the lining coat of the uterus.

The management, in the first case, consists in using pressure over the abdomen by a bandage, compression of the uterus externally by the hand, and dashing cold water upon the abdomen. If these means are not adequate, the hand is to be introduced into the uterus, and gently moved about in it, until contraction comes on, and the placenta is expelled.

When the placenta is retained by spasmodic contraction, the usual treatment is to give a dose of forty or fifty minims of Tr. opii; after a short time the contraction relaxes, and the hand may be gently passed up to assist the relaxation.

The adhesion of the placenta to the uterus depends on previous inflammatory action, with the deposit of a coagulable lymph.

When it is found to exist by the retention of the placenta, retraction of the umbilical cord, and hæmorrhage, the hand must be introduced into the uterus, and two fingers gently passed between the placenta and uterus to separate the adhesions, and great care should be taken to bring away every portion of it.

Protracted labours include lingering, difficult, and instrumental. They depend either on an insufficient power in the uterus, or undue resistance in other parts, and may be subdivided into cases which terminate by the uterine efforts, and those which demand the use of instruments.

Lingering or *protracted labour* many depend on *atony or feeble action of the uterus*, brought on by low diet and other debilitating causes.

The treatment will consist in administering mild nutritious diet, using friction over the abdomen, or giving moderate doses of opium; these are the cases which require the ergot of rye to be given in doses of gr. xx. to gr. xxx. of the powder, or an ounce and a half of a decoction made with two drachms to eight ounces of water, given every ten minutes.

Plethora sometimes diminishes the proper contractions of the uterus, and requires the removal of blood from the arm.

An excess of liquor amnii diminishes the contractile power of the uterus by the distension which it occasions. The remedy consists in puncturing the membranes, either by a probe or quill,

or scratching an opening through them with the finger-nail. This should not be done till the os uteri is well dilated.

Rigidity of the os and cervix uteri requires generally abstraction of blood from the arm, and purgatives. The French recommend rubbing extract of belladonna over the os uteri, which is said to be very useful in producing dilatation, but is a practice not followed by British accoucheurs.

Rigidity of the external parts requires fomentations and the application of lard in the vagina. The perineum is to be particularly guarded in these cases.

Distension of the bladder requires the introduction of the catheter to draw off the urine, and an accumulation of fæces in the rectum is to be remedied by the use of enemas.

Shortening of the funis.—In this case, patience is the only remedy, but care must be taken that the funis is not ruptured or torn from its insertion in the umbilicus. There are numerous other causes of lingering labour detailed by authors; and, amongst them, tumours of different kinds. The ingenuity of the accoucheur must supply the place of rules of treatment, which cannot be laid down for every possible case.

Labours which require instruments.—If the uterus, after long continued efforts, loses its power, and is incapable of expelling the fœtus; or, when the fœtal head is impacted in the pelvis, and the natural powers are inadequate, recourse must be had to instrumental assistance. In using instruments compatible with the life of the child, there are a few general rules to be attended to:

Let the bladder and rectum be evacuated, the first by the catheter, the second by an enema, if required.

The os uteri must be dilated, and the external parts must be in a yielding state.

Introduce the instruments during the cessation of pain.

Use the instruments in such a way as to assist the natural efforts; that is, during the contraction of the uterus; if the powers of the uterus are lost, imitate nature in allowing short intervals of repose.

Employ the extracting power according to the axis of the various parts.

If pain is produced by the instruments, remove them, and replace them with greater caution.

Directions for applying the forceps.—Place the patient at the edge of the bed on her left side; take the half of the forceps in the left hand, introduce the blade over the upper part of the child's head, guiding it with the index-finger of the right hand: then take the other blade in the right hand, and introduce it opposite to the first, and lock them together: when this is done, gentle traction may be used from one blade towards the other, keeping in mind the different bearings of the parts to be passed. Some practitioners introduce the lower blade first.

The *application of the forceps* is required in those protracted cases in which uterine action has ceased, or nearly so; or in which there is want of room, hæmorrhage, or convulsions, and in which it is requisite to expedite delivery. In all cases when the head is in the pelvis, the forceps should be applied in a direction from the occiput

to the chin, or vice versâ; and in each case, it is necessary to feel one of the ears, as it is over them that the instrument passes.

Face presentations are very unfavorable and tedious, and require particular management. If the chin is opposed to the pubes, and discovered early, the position may be rectified by depressing the occiput, and elevating the face with the fingers.

Presentations of the forehead and ear may generally be much assisted by mild application of the lever, used so as to depress the occiput and elevate the chin or ear.

The long forceps are requisite in those cases in which there is slight diminution of the natural size of the brim of the pelvis; and in cases of hæmorrhage or convulsions, when the child's head rests on the brim.

They must be applied in such cases over the occiput and face, and traction be used from side to side, remembering also the axis of the parts.

The *operation of embryotomy* is requisite in those cases in which the pelvis is deformed or distorted, in case of ossification of the bones of the cranium of the fœtus, or distension of the head by fluid. The Cæsarian section has been resolved upon in some such cases; and, in many, premature labour has been induced with success.

The distance between the pubis and sacrum must not be more than two inches and a half.

The *instruments* are the *perforator*, to make an opening in the head, and the *crotchet*, which is a sharp-pointed hook, or, in place of it, preference is now given to the craniotomy forceps of Dr. Davis or Mr. Holmes.

In performing this operation, the uterus must be fixed by pressure upon the abdomen; the operator then passes up two fingers in the vagina, to the head of the fœtus, guiding the perforator, which is introduced in one of the fontanels; the opening is then to be enlarged by a rotatory motion of the instrument.

The craniotomy forceps are then to be introduced, in order to grasp the bones of the head; and traction is to be used according to the axis of the parts to be passed.

If the head requires opening in face presentations, the perforator must be introduced just above the nose; and, if it is requisite after expulsion of the extremities, it must be passed in just above the ear.

Symptoms of death of the fœtus in utero.—Immobility of the fœtus; sensation of weight; uterus relaxed and yielding; complexion sallow or pale; loss of appetite; uneasiness; diarrhœa; fever; and diminution in size of the breasts and abdomen.

The Cæsarian section is considered necessary, if, at the full period of utero-gestation, the distance from the symphysis pubis to the promontory of the sacrum be less than one inch and three quarters, and the largest diameter of the pelvis is less than two inches and a half.

It is also supposed that the fœtus is of full growth.

Place the patient on her back, cut down on the linea alba with a scalpel about the length of four inches, then divide the peritoneum with a blunt-pointed bistoury; cut through the uterus to the same extent and in the same direction; extract

the fœtus and placenta through the opening, and apply a bandage gently around the abdomen. The section of the abdomen is sometimes necessary if the uterus becomes ruptured, and the contents are poured into the abdomen, whilst the os and cervix uteri are not well dilated, or dilatable.

It has been recommended to bring on labour prematurely, if it is ascertained that it is impossible for a child to be expelled alive at the full time. The operation consists in puncturing the membranes, or by introducing a finger to detach the decidua as far as possible from around the cervix uteri. Parturition comes on in a short time afterwards, and is to be managed according to the presentation, as in other cases.

The *feet* usually present in two positions, viz. with the toes towards one of the sacro-iliac symphyses; if they present towards the sacrum, or symphysis pubis, a turn must be made by grasping the nates, to give the inclination requisite for the head to pass through the brim. If the arms can be easily reached, they should be brought down before the head, and the finger may also be passed up to depress the chin, which will diminish the length of the axis of the head.

If one foot presents, endeavour to bring down the other, by placing a finger in the groin.

The *knees* presenting require the same management.

In preference to performing the Cæsarian section, in consequence of the frequent unfavorable terminations, some accoucheurs recommend that nature be trusted to, for getting rid of the fœtus; which has been effected by a communication

formed with the intestines, and the passage of the fœtus piecemeal.

Presentations of the *breech* are generally known by an escape of meconium, by the external organs of generation, and the anus.

These presentations require usually little manual assistance until the feet are brought down, and then they may be managed as footling cases.

There are other presentations, such as of the *upper extremities*, *back*, *abdomen*, *nape of the neck*, and *throat*, which require the introduction of the hand into the uterus to find the feet or knees, and bring them down by the operation called *turning*.

Vertex presentations, under peculiar circumstances, require to be managed in the same manner.

Turning is also requisite in *convulsions*, *dangerous hæmorrhage*, and *torpor of the uterus*. The operation of turning is thus performed: the patient may be placed as usual on her left side, the bladder and rectum must be evacuated, and the os uteri well dilated; then, during an interval of pain, introduce one hand into the uterus, rupture the membranes, then pass the hand carefully along the inside of the membranes, over the body of the fœtus, and take hold of the feet, which are generally towards the abdomen, grasp them, and bring them out of the external parts. Alter the position by giving the body a slight turn, from outwards inwards; disengage the arms, first the one behind; depress the shoulder, and pass the finger over the head and chin; give to the head its motion of flexion; place the fingers of one hand on the occiput, which recedes, and the fin-

gers of the other hand on the face, to lower the head; repeat the turn, place the fingers of one hand near the mastoid process, those of the other on the sides of the chin; support the perineum, and allow the face to emerge first.

If the *funis* presents, the object will be always to return it to the uterus, and to keep it there in any possible manner. A sponge has been sometimes used for that purpose; but this, as well as the other means recommended, is generally inadequate. If it cannot be returned, let it be placed in such a part of the pelvis as to make it least subject to pressure. Turning is sometimes resorted to in these cases, to save the life of the child, at the earnest request of the mother.

Twin cases. Management.—In cases of plurality of children, the principal object is to prevent hæmorrhage, which may arise from atony of the uterus, produced by excessive distension. When it is ascertained, after the birth of the first child, by examination per vaginam, and by placing the hand upon the abdomen, that there is another fœtus in utero, and uterine action does not come on after waiting a short time, the hand may be passed up to ascertain the presentation, and to rupture the membranes; if turning be requisite, it should be done immediately, and then it is proper to wait till contraction comes on. In extracting the placentæ, they should be brought away together by coiling the two cords about each other. Subsequently, a bandage should be carefully applied round the abdomen, and great care taken to prevent the occurrence of hæmorrhage, which is not uncommon from the large surface of the uterus connected with the placenta.

The symptoms of *convulsions* during labour are, pain in the head, vertigo, and loss of consciousness; oppression at the epigastrium, turgidity of the vessels, especially about the head and neck; hurried respiration, attended with a tremulous hissing noise; rigidity of the voluntary muscles during the paroxysm.

Convulsions occur more frequently in first labours, and generally depend upon plethora in an irritable habit, irritation of the os and cervix uteri, and indigestion.

Treatment.—Relieve the plethora by bloodletting from the arm, temporal artery, or jugular vein; shave the head, and apply cold to it; give nauseants, such as tartar emetic; apply sinapisms to the feet or legs, and dash cold water suddenly over the body.

Relieve the uterus as soon as possible. When dilatation of the os uteri ensues, expedite delivery, but by the mildest possible means.

Hæmorrhage occurs before, during, or after labour. When it occurs before, the treatment adopted is that for abortion, keeping the patient in the recumbent position, abstaining from heating food or drinks, and administering cold acidulated drinks. It most frequently comes on at about the seventh month, and depends upon the attachment of the placenta over or near to the os uteri.

Hæmorrhage coming on during labour, is either accidental or necessary, the first occasioned by a slight detachment of the placenta at some part of the fundus or corpus uteri, the second depending on its being placed upon the os and cervix uteri. In the first case, if the hæmorrhage is consider-

able, labour must be hastened by rupturing the membranes and turning; but, if it be slight, it will be better to wait and assist the uterine efforts.

In unavoidable hæmorrhage, the placenta is attached about the os uteri, which, being dilated, detaches a portion, and thus produces the discharge of blood.

If the placenta be attached rather on one side, the hand must be passed up by the space unoccupied, to grasp the feet and turn the child; but, if it is directly over the os uteri, the fingers and hand must be passed through its substance, in order to accomplish the object of turning: some recommend that in all cases the hand should be passed up on either side, and not through the substance. The rest of the treatment may easily be inferred.

Hæmorrhage after labour results generally from torpor of the uterus, depending on a variety of causes.

The general treatment consists in stimulating the uterus externally, by friction, or by passing up the hand internally, or in the application of cold.

Hæmorrhage takes place sometimes internally into the uterus, forming large coagula, which assist in stopping the mouths of the bleeding vessels.

The general treatment of all hæmorrhages is the same. Remove the exciting cause, place the patient in the recumbent posture, with the feet rather raised above the rest of the body; ventilate the room with cool air; administer cold, iced, or acid drinks; apply cold wet napkins to the pubes and abdomen, and enjoin the greatest quietude. Introduce some cold body into the vagina, such as a piece of ice, to hasten the formation of

coagula, plug the vagina, and apply a bandage gently round the abdomen.

In some cases, hæmorrhage takes place to such an extent as to leave the system incompetent to rally under any common modes of treatment. Transfusion has been recommended under such circumstances, affording the only hope of recovery.

The operation consists in injecting fresh-drawn human blood into one of the veins of the patient, generally the cephalic or basilic, to the extent of twelve or sixteen ounces. It must be done gradually, or it will bring on fatal consequences. Vide Waller's Elements of Midwifery.

Infants are sometimes born in a state of *asphyxia*, brought on by the continued pressure, or by a quantity of mucus filling up the mouth and fauces.

Treatment.—Before tying and dividing the cord, immerse the child in warm water, or apply a hot wet flannel to the chest; use friction over the heart; remove any mucus from the mouth, and inflate the lungs by blowing into the mouth, closing the nostrils, and pressing the larynx against the œsophagus at the same time; when the child happens to have suffered from plethora, some recommend that a little blood should be allowed to escape by the funis, and that cold should be applied to the chest by sprinkling of water, and to the face by blowing cold air upon it.

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187. Anxietas, medico sensu, oritur imprimis a causa quacunque sanguinis motum, per cor vasaque magna prope cor pulmonemque, turbante vel impediente. Hinc vitia cordis ejusque vasorum multiplicia, amplificationem, constrictionem, conversionem in os, polypum, palpitationem, syncopen, inflammationem, debilitatem, et ideo nonnullos animi affectus.

187. Anxiety, in a medical sense, arises especially from every cause disturbing or impeding the motion of the blood through the heart, and the large vessels near the heart and lungs. Hence it accompanies the numerous disorders of the heart and its vessels; such as enlargement, narrowing, ossification, polypus, palpitation, syncope, inflammation, debility, and, consequently, some affections of the mind.

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XIV. Si vero tertiana, quæ ex toto intermittit, aut quartana est; mediis diebus, et ambulationibus uti oportet, aliisque exercitationibus, et unctionibus. Quidam ex antiquioribus medicis Cleophantus in hoc genere morborum, multo ante accessionem, per caput ægrum multa calida aqua perfundebat, deinde vinum dabat. Quod, quamvis pleraque ejus viri præcepta secutus est Asclepiades, recte tamen præteriit: est enim anceps.

XIV. If it is a tertian or quartan, which intermits completely, on the intermediate days, it is proper to have recourse to both walking and other exercises and anointing. One of the more ancient physicians, named Cleophantus, in this kind of disease, some time before the paroxysm, bathed the patient from over the head, with a great quantity of warm water, and then gave him wine, which Asclepiades, however, has properly omitted, although he followed most of the precepts of that man: for it is doubtful (as to its good effect.)

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